UPDATE REPORT

REDUCTION OF TOXIC CHEMICALS FROM ONTARIO POINT SOURCES DISCHARGING TO THE NIAGARA RIVER 1988

DECEMBER 1989

Environment Ontario

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Minister

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REDUCTION OF TOXIC CHEMICALS FROM ONTARIO POINT SOURCES DISCHARGING TO THE NIAGARA RIVER
1988

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EXECUTIVE SUMMARY

This report documents the toxic chemical loadings, from the eight significant Ontario industrial and municipal dischargers to the Niagara River for the 1987-1988 and 1988-1989 sampling periods. The total loadings for these two periods are 30 kg/d and 22 kg/d respectively.

In addition, calculations of the reductions in toxic chemical loadings are made using the Niagara River Toxics Committee baseline data (1981-1982) and the 1986-1987 data from the previous status report "Update Report, Priority Chemical Loadings From Ontario Point Sources Discharging To The Niagara River 1981 to 1987".

The eight significant point sources show an overall load reduction to the Niagara River of 80% or 122 kg/d between 1981/82 and 1987/88 and 86% or 131 kg/d between 1981-1982 and 1988-1989. Comparing the data from the past two sampling years with the 1986/87 data, reductions of 50% (31 kg/d) and 64% (39 kg/d) were achieved.

INTRODUCTION

In 1981, the Niagara River Toxics Committee (NRTC) was formed to conduct an extensive investigative program to determine the environmental quality of the Niagara River. The committee consisted of representatives from Environment Canada, the Ontario Ministry of the Environment, the United States Environmental Protection Agency and the New York State Department of Environmental Conservation. The goal was to determine what toxic chemicals were in the river, identify sources, recommend activities to control the pollution and establish procedures to monitor the effectiveness of these activities.

In 1984 the NRTC issued its report summarizing the input of priority pollutants and special categories of organic contaminants into the Niagara River. In the section which dealt with point sources, industrial and municipal discharges from both the Ontario and New York sides of the river were found to contribute a total loading of 1407 kg/day of toxic contaminants to the river. A total of 17 point sources were identified in Ontario, eight of which were found to be significant. The Ontario significant point sources were found to contribute 11% or 152.2 kg/day of the total U.S. and Canada loading.

On February 4, 1987, a Declaration of Intent was signed by representatives of the four environmental agencies which have jurisdiction along the Niagara River. The aim of the Declaration of Intent was a 50% reduction of loadings of persistent toxic chemicals of concern into the river by 1996. The Declaration of Intent combined with a detailed workplan is known as The Niagara River Toxics Management Plan (NRTMP).

The goal of the NRTMP is to reduce loadings of toxic chemicals to the Niagara River in accordance with a timetable and set specific activities. A Coordination Committee, Secretariat and six technical committees (River Monitoring, Point Sources, Non-Point Sources, Categorization, Standards and Criteria and Fate of Toxics) carry out the work plan.

There are three major requirements for the Ministry of the Environment under the 1988 plan for point sources:

- By March, 1989 the Ministry of the Environment shall produce a report to:
  - identify those point source dischargers that contribute one or more of the ten chemicals that are targeted to be reduced by 50% by 1996. This report titled "Priority Toxic Chemicals Of Concern From Ontario Point Sources Discharging To The Niagara River 1988" was issued in June 1989.

- provide schedules on a facility-specific basis that will ensure that attainment of the 50% reduction goal for point sources, to the extent possible within existing laws and regulations;

- identify the technical, legal and regulatory impediments, if any, that interfere with the attainment of the 50% reduction goal for point sources; and

- recommend how to refine the point source loadings estimates for all priority toxics.

- By June, 1989 the Ministry of the Environment produce a Point Source Program Status Report describing the status of existing and developing toxics control programs affecting the Niagara River and include schedules for the full implementation of these programs. The issuance of this report is undetermined at this time.

- By September, 1989 the Ministry of the Environment will prepare a report summarizing progress in reducing the point source loadings of the full range of toxics monitored in municipal and industrial treatment plant effluents. (current report)

Seven of the eight significant sources are required to participate in Ontario Ministry of the Environment self monitoring programs: these are the Industrial Monitoring Information System (IMIS) and the Utilities (municipal) Monitoring Information System (UMIS) which require facilities to submit monthly laboratory analytical results of their influent and effluent to the Ministry of the Environment. The results of this program are released annually in the "Report on the Industrial Direct Discharges in Ontario" and "Report on the Discharges from Sewage Treatment Plants in Ontario". These reports summarize compliance by the facilities with Ministry requirements under formal abatement programs, Control Orders, Requirements and Direction or Certificates of Approval.

A new compulsory program recently established in Ontario, the Municipal-Industrial Strategy for Abatement (MISA) has the goal of virtual elimination of persistent toxic contaminants from all direct dischargers to Ontario waterways. It will establish an abatement program for all the major specific toxic pollutants from both industrial and municipal sources. Waste streams for each discharger will be analyzed. Hazardous pollutants will be identified, and discharge standards will be set using as a criterion the best available pollution control technology economically achievable (BATEA). Industries will be required to monitor discharge streams, report on the presence and quantities of toxics in their wastewater and carry out abatement action to

meet discharge limits. As a result, pollution reductions are anticipated from most dischargers.

Specific abatement activities relating to the eight significant point sources for the period 1987 to 1989 are discussed later in the Abatement Actions section.

The data obtained and summarized in this report for the Niagara River monitoring program are representative of a 56 hour or 2.3 days per year sampling period. Although it is recognized as a statistically valid data base, it should not be regarded as a true reflection of the total effect on the river.

LEGISLATION

In Ontario, the Environmental Protection Act and the Ontario Water Resources Act provide for the control of discharges to the natural environment. For example:

A) The Ontario Water Resources Act; Revised Statutes of Ontario, 1980, as revised April 1989, Chapter 361, Section 16

16. - (1), Every person that discharges or causes or permits the discharge of any material of any kind into or in any waters or on any shore or bank thereof or into or in any place that may impair the quality of the water of any waters, is guilty of an offense. R.S.O. 1980, C.361, S.16(1); 1988, c.54, s.61.

B) The Environmental Protection Act; Revised Status of Ontario, 1980, as revised October 1988, Chapter 141, Section 13

13. - (1), Notwithstanding any other provision of this Act or the regulations, no person shall discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment that causes or is likely to cause an adverse effect. R.S.O. 1980, C.141, S.13(1), 1988, c.54, s.10.

Control orders, program approvals and various regulations are the means used for the implementation of pollution control which are derived from these acts.

The goal of the Municipal-Industrial Strategy for Abatement (MISA) program is virtual elimination of toxic contaminants in municipal and industrial discharges into Ontario waterways. This goal will be achieved through the development and implementation of regulations which include monitoring requirements and effluent limits. With the implementation of MISA, further control and reduction of toxic compounds in the Niagara River will be attained. Currently, three of the eight significant point sources (Atlas Specialty Steels, Cyanamid of Canada Ltd. - Niagara Falls Plant and Cyanamid of Canada Ltd. - Welland Plant) have been included in the promulgated Monitoring Regulations.

Also through the MISA program, a sewer use control program is also being developed to control industrial discharges into municipal sewage treatment plant systems, which in turn discharge into Ontario waterways. This program will include legislative requirements, implementation activities, enforcement mechanisms and information handling mechanisms. It will require industrial dischargers to virtually eliminate toxic contaminants from their waste by utilizing methodologies, such as pre-treatment, before

they discharge to sanitary sewer systems. It is anticipated that there will be an improvement in effluent quality at the Niagara Falls (Stamford) WPCP, Welland WPCP and Fort Erie WPCP when the sewer use control program is implemented by the Regional Municipality of Niagara.

SAMPLING PROGRAM

Point Source Facilities

A significant point source was defined in the NRTC report (1984) as one whose effluent contained at least one individual priority pollutant in excess of an arbitrarily set cut-off level. Table 1 illustrates the cutoff levels for determining a significant source for the major classes of compounds as determined by the NRTC.

TABLE 1

CUTOFF LEVELS DEFINING SIGNIFICANT DISCHARGES

	Category	Cutoff Level (kg/day)	(lbs/day)
1.	Heavy Metals (except Mercury)	0.454	1.0
2.	Volatile Organics	0.227	0.5
3.	Acid and Base/Neutral Extractable Organics	0.227	0.5
4.	Total Cyanide	0.227	0.5
5.	Total Phenolics (4AAP)	0.227	0.5
6.	Mercury	0.0454	0.1
7.	Pesticides/PCBs	0.0454	0.1

In the NRTC report, the Canadian Niagara River drainage basin was divided into three sub-areas; Fort Erie, Chippawa, and Niagara Falls Ontario. The Fort Erie sub-area comprises a short section of the upper river from its source to and including Frenchman's Creek. The Chippawa sub-area extends from Frenchman's Creek to the northern tip of Navy Island. The Niagara Falls Ontario sub-area encompasses the remainder of the Niagara River north to Lake Ontario and includes the input of the Welland River. Locations of the eight significant Canadian Point Sources to the Niagara River may be found in Figure 1.

Fort Erie Sub-Area

One municipal and three industrial facilities were identified in this sub-area. The Fort Erie (Anger Ave.) WPCP (an enhanced primary wastewater treatment plant) and Fleet Manufacturing, were the only facilities designated as significant sources.

Non-significant sources of pollutants were identified at Canadian Oxy Chemicals-Durez Division and Gould Manufacturing. These have, therefore, been designated as minor sources. Recently, Gould Manufacturing has eliminated its discharge to Frenchman's Creek and has directed its effluent to the Fort Erie

(Anger Ave.) WPCP. In addition due to contamination of the stream bed which conveyed the effluent from Gould to the Niagara River, the company has completed remediation of lead contaminated sediment in order to prevent contaminated sediment from migrating to the Niagara River.

Chippawa Sub-Area

At the time of the NRTC report (1984), there was only one non-significant point source identified in this area which was Holiday Farms Limited. A second non-significant point source was added with the construction of the Stevensville-Douglastown Municipal Sewage Treatment Lagoons in 1983.

Niagara Falls Ontario Sub-Area

The Niagara Falls sub-area contains the majority of point sources on the Canadian side of the Niagara River. Four municipal sources and eight industrial facilities were identified in this area.

Based on the previously defined cutoff values, Niagara Falls WPCP, Welland WPCP, and McMaster Ave. Combined Sewer have been designated significant municipal sources.

On the same basis, Atlas Specialty Steels Division, Cyanamid of Canada Ltd. - Welland Plant and Cyanamid of Canada Ltd. - Niagara Falls Plant, have been designated significant industrial sources.

Stanley Ave. Sewer, Stelco-Welland Tube, B.F. Goodrich, Ford Glass Plant, Norton Company, and Electro Minerals (formerly Sohio and Canadian Carborundum) have all been designated non-significant sources.

Sampling Methods

For the 1987-1988 and 1988-1989 monitoring periods, both the influent or raw water supply and effluent were sampled at the industrial and municipal facilities. Composite samples were collected on a time proportional basis, using an automatic (Isco 2700) sampler, compatible for organic sampling, over three consecutive days. With the automatic sampler, the compositing period of 56 hours in total was subdivided into three periods of 24, 24 and 8 hours respectively. For the 24 hour compositing period, samples were collected every 20 minutes, while for the 8 hour period, every 6 minutes. The composite samples were collected in a 9 L glass container. In the cases where the use of automatic samplers were not possible, manual grab samples were collected and composited five times per day, over an 8 hour period.

Due to the nature of automatic samplers, it was inappropriate to use the sample collected by the ISCO 2700 for the analysis of volatile organic compounds. Volatile organic samples were therefore collected as a series of 5 grab samples over an 8 hour period each sampling day. The samples were then composited prior to analysis. The composited sample collected by the automatic sampler was used for all other analytical tests. Replicate samples were randomly collected and submitted for all analytical tests to ensure that quality assurance and quality control requirements were met. Field samples requiring stabilization were preserved and kept cool after collection prior to transportation for analysis at the Ministry of the Environment Central Laboratory in Rexdale.

Flow measurements were taken in the field 4 to 5 times per sampling day over an 8 hour period where no permanently installed flow monitoring devices existed, otherwise actual 24 hour flow discharge data were obtained from the facility's records. The flow measurements were essential in order to determine the loading of contaminants to the receiving waterbody.

Analytical Methods

Pollutant Categories

Contaminants are aggregated by priority pollutant categories reflecting their analytical groupings. The priority pollutant analytical groupings are defined as follows:

Acid Extractables: organic compounds which are weak acids and polar and which can be extracted from water with methylene chloride after the pH has been adjusted to 2.0. Phenols and substituted phenols are major components of this class.

Base/Neutral Extractables: organic compounds which are either non-polar or have strong basic functional groups. A much larger and more diverse group of compounds is found in this category than in the acid extractables.

Polynuclear Aromatic Hydrocarbons (PAH's): a class of base/neutral extractable organic compounds characterized by a condensed aromatic ring structure of 5 and 6 carbon atoms. All rings are fused, with each sharing at least one carbon-carbon bond with another ring.

Polychlorinated Biphenyls (PCB's): a class of base/neutral extractables, heavily chlorinated and very stable analogs of the biphenyl molecule. These compounds have a structure of two benzene rings formed by the elimination of a hydrogen atom from each. Chlorine atoms are the major substituent found at all other ring positions. Because of the large

number of isomers possible, PCBs give a multipeak response chromatographically and are classified generally by the degree of chlorination present. PCBs such as Arochlor-1242, for example, have 42 percent chlorine content by weight.

Pesticides: a large group of base/neutral extractable compounds, characterized by biocidal properties. They encompass a wide variety of structural groups. Toxicity occurs with the presence of one or more chlorine atoms and the compounds are referred to as organo-chlorine pesticides.

Volatile Compounds: compounds which because of their low molecular weight and high vapour pressure can be readily removed from water by aeration.

Cyanides: includes the cyanide ion generally referred to as simple cyanide and the more complex forms which do not dissociate in water.

Metals: those metals which have defined toxic thresholds and bioaccumulation potential in the environment.

Table 2 shows all parameters measured under these groupings.

Sample Preservation

A variety of sample containers were utilized in the surveys owing to the wide range of parameters to be analyzed. In addition, many analytical procedures call for sample preservation in the field at the time of sampling to stabilize the target parameters (e.g. metals, cyanide). The type of sample bottle, its preparation for sampling, and appropriate preservation technique are described below.

Conventional Parameters Analysis

Samples for the analysis of conventional parameters were collected in 500 mL polyethylene teraphthalate (PET) containers. Preservation of the samples was attained through refrigeration.

Heavy Metals Analysis

Samples for the analysis of metals were collected in 500 mL PET bottles. The samples were preserved by acidification using concentrated nitric acid (HNO_3) after the sample was in the bottle in order to achieve a sample pH of less than 2 pH units.

Mercury samples were collected in 250 mL glass bottles. Preservation was accomplished by acidification using concentrated nitric acid (HNO_3) and potassium dichromate solution to obtain a yellow colour.

TABLE 2
NIAGARA RIVER POINT SOURCE MONITORING PARAMETERS

CONVENTIONALS

- flow
- specific conductance
- total alkalinity
- pH
- chloride
- residue, filtrate
- residue, particulate
- residue, total
- phosphorus
- phosphates
- TKN
- NH4
- NO3 + NO2
- NO2
- NO3
- BOD5
- COD
- solvent extractables
- phenolics
- total organic carbon
- total organic halogens
- PAHs (total)

METALS & CYANIDE

- silver
- aluminum
- arsenic
- barium
- beryllium
- calcium
- cadmium
- cobalt
- cyanide
- chromium
- copper
- iron
- mercury
- magnesium
- manganese
- molybdenum
- sodium
- nickel
- lead
- antimony
- selenium
- strontium
- titanium
- thallium
- vanadium
- zinc

VOLATILE ORGANICS

- chloromethane
- dichloromethane
- chloroform
- carbon tetrachloride
- bromomethane
- dibromomethane
- bromoform
- chlorodibromomethane
- dichlorobromomethane
- dichlorodifluoromethane
- trichlorofluoromethane
- dichloroiodomethane
- chloroethane
- 1,1-dichloroethane
- 1,2-dichloroethane
- 1,1,1-trichloroethane
- 1,1,2-trichloroethane
- 1,1,2,2-tetrachloroethane
- pentachloroethane
- chloroethylene
- 1,1-dichloroethylene
- 1,2-dichloroethylene (trans)
- 1,2-dichloroethylene (cis)
- trichloroethylene
- tetrachloroethylene
- 1,1-dichloropropane
- 1,2-dichloropropane
- 1,2-dichloropropylene
- 1,3-dichloropropylene (trans)
- 1,3-dichloropropylene (cis)
- benzene
- chlorobenzene
- 1,2-dichlorobenzene
- 1,3-dichlorobenzene
- 1,4-dichlorobenzene
- ethylbenzene
- toluene
- chlorotoluene
- chlorotoluene trifluoride
- ortho-xylene
- meta-xylene
- para-xylene
- bis-chloromethyl ether
- 2-chloroethylvinyl ether

BASE NEUTRAL EXTRACTABLE ORGANICS

- bis-(2-chloroethoxy) methane
- hexachloroethane
- butoxyethoxyethanol
- hexachlorobutadiene
- hexachlorocyclopentadiene
- n-nitrosodimethylamine
- n-nitrosodi-n-propylamine
- n-nitrosodiphenylamine
- diphenylamine
- diphenylether
- bis-(2-chloroethyl) ether
- bis-(2-chloroisopropyl) ether
- 4-chlorophenyl phenyl ether
- 4-bromophenyl phenyl ether
- 1,2,3-trichlorobenzene
- 1,2,4-trichlorobenzene
- 1,2,5-trichlorobenzene
- 1,3,5-trichlorobenzene
- 1,2,3,4-tetrachlorobenzene
- 1,2,3,5-tetrachlorobenzene
- 1,2,4,5-tetrachlorobenzene
- pentachlorobenzene
- hexachlorobenzene
- nitrobenzene
- 2,3-dinitrotoluene
- 2,4-dinitrotoluene
- 2,6-dinitrotoluene
- dimethyl phthalate
- diethyl phthalate
- dibutyl phthalate
- di-n-octyl phthalate
- di-isooctyl phthalate
- bis (2-ethylhexyl) phthalate
- benzylbutyl phthalate
- di-t-butyl methyl phenol
- p-chloroaniline
- benzothiazole
- napthalene
- 1-methylnapthalene
- 2-methylnapthalene
- 1-chloronaphthalene
- 2-chloronaphthalene
- tetrachloronaphthalene
- pentachloronaphthalene
- hexachloronaphthalene
- octachloronaphthalene
- acenaphthalene
- acenaphthene
- 5-nitroacenaphthene
- acrolein
- acrylonitrile
- anthracene
- benz(a)anthracene
- dibenz(a,h)anthracene
- benzidine
- 3,3'-dichlorobenzidine
- caffeine
- cholestrol
- chrysene
- camphene
- fluorene
- fluoranthene
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- indole
- isophorone
- phenanthrene
- pyrene
- benzo(a)pyrene
- indeno(1,1,2-c,d)pyrene
- perylene
- benzo(g,h,i)perylene
- octachlorostyrene
- 1,2-diphenylhydrazine

TABLE 2 (Con't)

NIAGARA RIVER POINT SOURCE MONITORING PARAMETERS

ACID EXTRACTABLE ORGANICS
phenol
2-chlorophenol
3-chlorophenol
4-chlorophenol
2,4-dichlorophenol
2,5-dichlorophenol
2,6-dichlorophenol
2,3,4-trichlorophenol
2,3,5-trichlorophenol
2,3,6-trichlorophenol
2,4,5-trichlorophenol
2,4,6-trichlorophenol
3,4,5-trichlorophenol
2,3,4,5-tetrachlorophenol
2,3,4,6-tetrachlorophenol
2,3,5,6-tetrachlorophenol
pentachlorophenol
2-nitrophenol
4-nitrophenol
2,4-dinitrophenol
2,4,6-trinitrophenol
2,4-dinitro,6-methylphenol
2,4-dimethylphenol
4,6-dinitro-o-cresol
o-cresol
m-cresol
p-cresol
p-chloro-m-cresol
hexadecanoic acid

ORGANOCHLORINE PESTICIDES
aldrin (HHDN)
A-BHC(A-Hexachlorocyclohexane)
B-BHC(B-Hexachlorocyclohexane)
D-BHC(D-Hexachlorocyclohexane)
G-BHC(G-Hexachlorocyclohexane)
alpha-chlordane
gamma-chlordane
dieldrin (HEOD)
DMDT,Methoxychlor (methoxy-DDT)
endosulfan I (thiodan I)
endosulfan II (thiodan II)
endrin
endrin aldehyde
endosulfan sulphate
heptachlor
heptachlor epoxide
mirex (dechlorane)
oxychlordane
o,p-DDT
p,p'-DDD (TDE)
p,p'-DDE (DDX)
p,p'-DDT
hexachlorobenzene (HCB)
toxaphene (polychlorocamphene)
tetrachlorodibenzo-p-dioxins
2,3,7,8 - TCDD

POLYCHLORINATED BIPHENYLS
total PCB'S
arochlor 1016
arochlor 1221
arochlor 1232
arochlor 1242
arochlor 1248
arochlor 1254
arochlor 1260

ORGANO PHOSPHATE HERBICIDES
diazinon
dichlorovos
dursban
ethion
guthion
malathion
mevinphos
methylparathion
methyltrithion
parathion
phorate (thimet)
reldan
ronnel

Cyanide Analysis

Samples for cyanide analysis were collected in 500 mL PET bottles. A solution of 50% sodium hydroxide (NaOH) was added to ensure the samples were alkaline and a pH of greater than 12 pH units was maintained.

Total Phenolics Analysis

Samples for total phenolics analysis were performed using the 4-aminoantipyrine (4AAP) method and were collected in 250 mL glass bottles containing copper sulphate/phosphoric acid preservative, added at the laboratory prior to use.

Volatile Organic Pollutants Analysis

Samples for volatile organics analysis were collected in 250 mL glass bottles filling the bottles full with no head space. The purge and trap method was used to chromatograph the contaminants in the sample. A gas chromatograph, equipped with a mass selective detector was temperature programmed to improve separation of the volatile compounds.

The use of mass spectroscopy in conjunction with gas chromatography allowed organics which were not in the target group to be identified and as well as concentration levels to be estimated for those compounds. This estimate assumes that the purging efficiency of the analyte and the internal standard were identical, and that the GC behaviours and the mass spectrometric responses of both analyte and internal standard are identical. Any deviations from these assumptions would affect concentration estimates. The GC/MS open scans were primarily used too qualitatively identify unknowns in effluent samples.

Extractable Organics, Organo Chlorine Pesticides and PCB Analysis

Samples for acid and base/neutral extractable organics, organo chlorine pesticides and PCBs analysis were collected in 1 L brown glass bottles with teflon lined caps. Details of the methodology are reported in "Outlines of Analytical Methods", December 1983, Ministry of the Environment Laboratory Services.

Data Limitations

On the large scale, day-to-day fluctuations or long-term average quality are not identified with three days of sampling each year. The data therefore are inadequate to indicate the long-term average quality of the discharge in question. However, it should be realized that the limitation of insufficient frequency and duration in sampling is more related to resource limitations than to study design. With the advent of the MISA program, more comprehensive sampling will be undertaken.

The data in this report are presented as loadings to the Niagara River to reflect both contaminant concentrations and the flow discharged by each facility. Several of the companies though, discharge high volumes of wastewaters and cooling waters to the sanitary sewers. As a result, pollutants may be discharged without being detected due to the analytical detections limits. To illustrate this limitation, Table 3 illustrates the possible additional undetected load at certain analytical detection limits and at certain flows which may be discharged and not included in the report.

TABLE 3
POTENTIAL LOAD UNDETECTED (kg/d)

Analytical Detection Limit (ug/L)	Flow (m3/d) 2500	5000	25000	50000	100000
0.005	0.00001	0.00003	0.00013	0.00025	0.00050
0.020	0.00005	0.00010	0.00050	0.00100	0.00200
0.050	0.00013	0.00025	0.00125	0.00250	0.00500
1.000	0.00250	0.00500	0.02500	0.05000	0.10000
2.000	0.00500	0.01000	0.05000	0.10000	0.20000
5.000	0.01250	0.02500	0.12500	0.25000	0.50000

1 m3/d = 219.97 IGPD
= 264.17 USGPD

1987-1988 SAMPLING RESULTS

Summary of 1987-1988 Data by Facility

Atlas Specialty Steels produces specialty and stainless steel in electric arc furnaces by the reclamation of scrap steel. The total load from this facility was 7.04 kg/day. Heavy metals being the predominant class (6.71 kg/day) (Table 4) accounted for 95% of the total load. Arsenic, chromium, copper, nickel, lead and zinc were all above the cutoff level for heavy metals of 0.454 kg/day (Table 13). Copper, chromium and nickel are common alloying materials found at stainless steel and specialty steel manufacturing facilities. Cyanide was also found above cutoff levels. Trichloroethylene and 1,1,1 trichloroethane were found at low levels. Both are degreasing compounds. No extractable organics, organo chlorine pesticides or PCB's were found.

Cyanamid of Canada - Welland Plant manufactures primarily nitrogenous fertilizers. One discharge point was sampled at the flow measuring weir at Thompson's Creek. In 1987-1988, heavy metals accounted for 66% (1.00 kg/day) of the total loading of 1.53 kg/day (Table 5). Total phenolics and cyanide were also present with a cyanide load of 0.52 kg/day which exceeds the cutoff level (Table 15). There was no detection of volatile organics, extractable organics, organo chlorine pesticides or PCBs.

Cyanamid of Canada - Niagara Falls Plant manufactures calcium carbide, calcium cyanamide, calcium dicyandiamide and liquid nitrogen. Two discharge points were monitored; the effluent outfall to the Queenston-Chippawa Power Canal and the 54" outfall to Whitty's Creek (which discharges at the Whirlpool gorge of the Niagara River). A total loading of 2.29 kg/day was measured with heavy metals being the predominant class (Table 6). Heavy metals contributed a load of 1.47 kg/day with copper and zinc exceeding cutoff levels. Cyanide exceeded cutoff levels with a loading of 0.48 kg/day. Extractable organics were found with the compounds chrysene, fluoranthene and pyrene being present. Pyrene exceeded cutoff levels (Table 17). The extractable organics may originate from an old coal tar site located on the property from a previous coal gasification facility. Volatile organics and organo chlorine pesticides were also found in low level quantities.

Fleet Manufacturing produces various airplane and sonar components. There are two outfalls at this facility; the west sewer which transports non-contact cooling water and combined effluent from four outfalls on the east side of the plant which enters Frenchman's Creek at Garrison Road. In 1987-1988, heavy metals were again the predominant class though no individual metal was above the cutoff level (Table 7). There was a wide

range of volatile organics present but no cutoff exceedences (Table 19). The chlorinated ethanes and ethylenes found are degreasing compounds and may be present due to a contaminated ground water problem which has recently been identified. Di-octyl phthalate was found under the extractable organic class and may be due to a plastics sanding operation located at the facility.

Niagara Falls (Stamford) WPCP is a secondary treatment facility utilizing rotating biological contactors. Effluent is discharged to the Niagara River via the Queenston-Chippawa Power Canal. The total loading of 3.00 kg/day reveals the presence of all classes of contaminants (Table 8). Heavy metals with a load of 1.23 kg/day, show exceedences of copper and zinc. Total phenolics and cyanide also exceed NRTC cutoff levels. Several volatile organics were detected with methylene chloride exceeding cutoff as did butoxyethoxyethanol, an extractable organic (Table 21). Organo chlorine pesticides were also found in low quantities.

Welland (River Rd.) WPCP is a secondary (conventional activated sludge) treatment facility with phosphorous removal. The effluent is discharged directly into the Welland River. In 1987-1988, the total loading was 1.61 kg/day and was comprised primarily of heavy metals (1.25 kg/day) (Table 9). Zinc exceeded cutoff levels. Total phenolics, cyanide, volatile organics and organic chlorine pesticides were also detected but at levels below cutoff (Table 23).

Fort Erie (Anger Ave.) WPCP presently provides enhanced primary treatment with phosphorus removal and chlorination. The effluent is discharged directly to the Niagara River via a submerged outfall. The total loading of 12.79 kg/day contains all classes of toxic contaminants (Table 10). Extractable organics was the predominant class (11.37 kg/day) with dimethyl phthalate and o-cresol exceeding cutoff levels (Table 25). The presence of high levels of phthalates can be attributed to Lucidol, a division of Pennwalt Inc. being connected to the sanitary sewer and therefore to the sewage plant. Heavy metals, total phenolics, volatile organics, organic chlorine pesticides are present at below cutoff levels (Table 25). The presence of organic chlorine pesticides may be a ground water infiltration problem into the sewer system. A considerable amount of spraying is done in the area to control the spider population. Cyanide was also present above cutoff levels.

McMaster Avenue Combined Sewer discharges untreated combined sewage, primarily consisting of domestic sewage and industrial process wastewater with some cooling water, directly into the Welland River. All classes of toxic contaminants are represented in the total load of 1.85 kg/day (Table 11). Heavy metals is the most predominant class (1.21 kg/day) with zinc exceeding cutoff

levels (Table 11). No other exceedences occurred in the groups represented (Table 27).

Comparison of 1987-1988 Data with the 1981-1982 (NRTC Baseline Year) and 1986-1987 Data

This section of the report provides a comparison of the 1987-1988 sampling period with the baseline year of 1981-1982 (NRTC Report) and 1986-1987 data in terms of percent reduction of toxic loadings to the Niagara River from Ontario Point Sources.

In comparison to the 1981-1982 baseline year, Atlas Specialty Steels showed a reduction of 90.5% for total loading of toxic contaminants to the Niagara River. This equates to a 98.8% reduction of organics and 90.1% for inorganics. In comparison to the 1986-1987 year, a reduction of 92.3% for organics and 44.4% for inorganics (Table 4) was calculated. The total reduction for this period was 46.4%. This reduction for 1986/87 to 1987/88 can be attributed to an Abatement Program which was negotiated with the company in 1986/87 for ensuring preventative measures and good housekeeping maintainance at all effluent control processes at the facility.

Cyanamid of Canada - Welland Plant showed a reduction of 97.7% in organic load and 87.6% in inorganic load (Table 5). A total load reduction of 88.2% has been realized from the baseline year 1981-1982. The company produced a reduction in total effluent loading of 51.2% between 1986-1987 and 1987-1988 due primarily to a shutdown of approximately 50% of the process operation at the facility.

A total loading reduction of 5.8% was measured at the Cyanamid of Canada - Niagara Falls Plant from 1981-1982 to 1987-1988. The load of organics was reduced 53.7% while the load of inorganics increased by 15.3 %. For 1986-1987 to 1987-1988 there was an increase in total load by 85.8% from 1.23 kg/day to 2.29 kg/day (Table 6). There have been no modifications or improvements at this facility.

Fleet Manufacturing has reduced its total effluent load by 90.7% from the 1981-1982 baseline data; 64.0% for organics and 92.3 % for inorganics. From 1986-1987 to 1987-1988, a reduction of 39.3% was measured. The organic load decreased by 70.3% and inorganics by 12.4% (Table 7). This company has improved its awareness of environmental control and has implemented good housekeeping practices. No improvements to the company's effluent treatment processes have been required in the past year.

Niagara Falls (Stamford) WPCP had a reduction in total effluent load of 87.2% from 1981-1982 to 1987-1988. Organic load has decreased 76.5% and inorganics 91.0%. For 1986-1987 to 1987-1988, a reduction of total toxic load of 22.9% was experienced. Organics increased by 43.4% while inorganics decreased by 39.5% (Table 8). No further changes occurred at the facility during the 1986-1987 to 1987-1988 period.

Welland (River Road) WPCP decreased its load by 90.7 % between 1981-1982 and 1987-1988. There was a 48 % reduction in organics and a 92.1% reduction in inorganics. A 51.1 % reduction was measured from 1986-1987 to 1987-1988 due to an 68.4 % decrease in organic load and a 44.2% decrease in inorganic contaminants (Table 9).

Fort Erie (Anger Ave.) WPCP experienced no reduction in total effluent load between 1981-1982 and 1987-1988. The total load increased by 79.2 % with an increase in organics of 134.8 % and a decrease in inorganic load by 56.7 %. A 62.9 % reduction of total load did occur between 1986-1987 and 1987-1988 (Table 10). Between 1981 and 1987, Lucidol, a company that produced plasticizers discharged excessively high levels of phthalates directly to sanitary sewer and hence to the sewage treatment plant. It was not until 1987, that the facility began to improve its effluent quality and eventually discontinued their operations in 1987-1988.

The McMaster Avenue Combined Sewer showed a reduction of 86.6% of total toxic contaminants from 1981-1982 to 1987-1988. Organic load was reduced 13.7% and inorganics 90.7%. Between 1986-1987 and 1987-1988 an increase of 7.3% in total load was experienced. Organics increased by 9.1% and inorganics by 6.4% (Table 11). Between 1981 and 1987, the primary discharger to this sewer was Wabasso Cotton Mills which has since shutdown operations.

Overall, the eight significant point sources have reduced their load to the Niagara River by 80.2% (122 kg/d) between 1981/82 and 1987/88. Organics and inorganics were reduced by 16.8% and inorganics by 88.5% from 1981/82 to 1987/88. Comparing the data from the previous two sampling years (1987/88 and 1988/89) with the 1986/87 data, total reductions of 50% (31 kg/d) and 64% (39 kg/d) were achieved.

1988-1989 SAMPLING RESULTS

Summary of 1988-1989 Data by Facility

Total priority pollutant loading at Atlas Specialty Steels was 9.18 kg/day. The predominant class was once again heavy metals with arsenic, chromium, copper, nickel, lead and zinc all exceeding the cutoff levels established by the NRTC. Cyanide also exceeded cutoff levels. Total phenolics and volatile organics (1,1,1 trichlorethane and trichloroethylene) were also measured. There was no extractable organics, organo chlorine pesticides or PCBs detected at this facility (Table 14).

A total load of 0.33 kg/day was measured at Cyanamid of Canada - Welland Plant. Heavy metals, cyanide and volatile organics (benzene) were detected but at levels below cutoff. No total phenolics, extractable organics, organo chlorine pesticides or PCBs were detected at this facility (Table 16).

In 1988-1989 at the Cyanamid of Canada - Niagara Falls Plant, heavy metals were the predominant class with a loading of 0.24 kg/day. This represents 63.0% of the total load of priority pollutants (0.38 kg/day). Heavy metals, cyanide, volatile organics and organo chlorine pesticides were detected below cutoff levels (Table 18).

Fleet Manufacturing discharged a total toxic load of 0.10 kg/day. Heavy metals, total phenolics, cyanide and volatile organics were detected below cutoff levels. Heavy metals accounted for 82% of the total loading. Extractable organics, organo chlorine pesticides and PCBs were not detected (Table 20).

At the Niagara Falls (Stamford) WPCP the total priority pollutant loading was 3.79 kg/day. All classes of contaminants were detected. Heavy metals represented 42% (1.59 kg/day) of the total load with copper exceeding NRTC cutoff levels. Volatile organics accounted for 26% of the total load with chloroform and toluene exceeding cutoff levels. Total phenolics and bis (2-ethylhexyl) phthalate also exceeded cutoff levels. Cyanide and organo chlorine pesticides were detected below cutoff (Table 22).

Ninety percent of the total load (3.61 kg/day) was accounted for by heavy metals (3.26 kg/day) at the Welland (River Road) WPCP. Chromium and zinc exceeded cutoff levels. Total phenolics, cyanide, volatile organics and organo chlorine pesticides were detected at levels below cutoff. There were no extractable organics detected (Table 24).

Fort Erie (Anger Avenue) WPCP had a total effluent load of 2.98 kg/day. Extractable organics with a loading of 2.01 kg/day accounted for 67% of the total load. Diethyl phthalate and p-cresol exceeded the NRTC cutoff level. Heavy metals, total phenolics, cyanide, volatile organics and organo chlorine pesticides were also detected but at levels below cutoff levels (Table 26).

McMaster Avenue Combined Sewer had a total pollutant loading of 2.87 kg/day, 73% of which were heavy metals (2.10 kg/day). Zinc exceeded cutoff levels. Extractable organics which accounted for 20% of the load had p-cresol exceeding cutoff. Total phenolics, cyanide, volatile organics and organic chlorine pesticides were also detected at low levels (Table 28).

Comparison of 1988-1989 Data with 1981-1982 (NRTC Baseline) and 1986-1987 Data

This section provides a comparison of the 1988-1989 sampling data with the NRTC baseline year 1981-1982 and the 1986-1987 data. The results are presented in terms of percent reduction of the total loading of priority pollutants to the Niagara River and its tributaries.

Atlas Specialty Steels reduced its total loading by 87.6% between 1981-1982 and 1988-1989. This equated to a reduction in organic load of 99.2% and inorganic of 87.0%. For 1986-1987 to 1988-1989 the total reduction was 30.2%, with a decrease in organics of 30.2% and inorganics of 30.7%.

Cyanamid of Canada - Welland Plant showed reductions of 97.5% (99.8% organic and 97.3% inorganic) from 1981-1982 to 1988-1989. Between 1986-1987 and 1988-1989 a reduction of 89.5% for total loading was measured. Organic load decreased by 99.3% while inorganics decreased by 89.0%. A new Certificate of Approval was issued for this facility in 1988-1989 which requires a tightening of effluent limits. This would account for the improved reductions that were experienced.

Between 1981-1982 and 1988-1989 Cyanamid of Canada - Niagara Falls Plant reduced its total load by 84.5%. This included an organic reduction of 98.9% and an inorganic reduction of 78.2%. A reduction of 69.5% was experienced between 1986-1987 and 1988-1989 (92.2% organic and 67.4% inorganic).

Fleet Manufacturing has reduced its total loading to Frenchman's Creek by 92.5% since 1981-1982. The reduction between 1986-1987 and 1988-1989 was 51.5%. There have been no modifications to the treatment processes at the plant during this sampling year.

Niagara Falls (Stamford) WPCP has experienced a reduction in total load of 83.9% since 1981-1982. Organic load decreased by 67.2% and inorganic by 89.7%. For 1986-1987 and 1988-1989, the total loading of priority pollutants increased 5.2%. The load of organics increased by 100.4% while inorganics decreased by 31.1%. The effluent loading reductions at the plant seems to be levelling off with no large reductions in load being experienced from year to year. Any further reductions will only occur upon the implementation of the MISA Model Sewer Use By-Law.

Welland (River Road) WPCP has had a reduction in total load of 79.0% since 1981-1982 which is lower than the reduction from that year until 1987-1988. The total load has increased between 1986-1987 and 1988-1989 by 10.1%. The organic load has been reduced by 72.6% but the inorganic has increased 43.0%. Expansion of the plants capacity began in 1988. The effect that this will have on loadings can not be determined, however with the addition of effluent filtration it is expected that the effluent loading will decrease. Changes may also occur here with the implementation of the MISA Model Sewer Use By-Law.

Fort Erie (Anger Ave.) WPCP has reduced its loadings by 58.2% since 1981-1982. The reduction between 1986-1987 and 1988-1989 shows a decrease of 91.4% in the total loading of priority pollutants. The plant began expanding to secondary treatment in 1988 and should result in additional reductions in future monitoring programs. Commissioning of the plant should be in early 1990.

McMaster Avenue Combined Sewer shows a decrease in total loadings of 79.2% between 1981-1982 and 1988-1989 but shows an increase of 66.6% for 1986-1987 to 1988-1989. The reason for this increase is not known. Connection of McMaster Ave. sewer to the Welland WPCP has been completed. As a result, there will be an increased influent load to the plant. However, with the expansion in plant capacity, the additional flow may have no impact.

Overall, the eight significant facilities have reduced loadings to the Niagara River by 85.7% (131 kg/d) between 1981-1982 and 1988-1989. There was a reduction of 77.0% of organic load and 86.8% for inorganics. The reduction since 1986-1987 for total loading of priority toxics was 64.1%. Organics decreased by 88.9% and inorganics by 26.3%.

ABATEMENT ACTIONS BY MINISTRY (1987-1989)

Abatement and enforcement actions have been ongoing during the 1987 to 1989 time period. A wide range of activities have been progressing at several of the Ontario significant and non-significant point sources that will have an impact on future monitoring programs at these facilities.

Atlas Specialty Steels have complied with a control order (1981) and have brought their acid treatment facility to design specifications. The effluent also receives further treatment via sand filtration. The company has begun a practice of sewer flushing to remove contaminated sediments and have rerouted streams through treatment systems before discharge.

Cyanamid of Canada - Welland Plant installed an effluent equalization basin in the fall of 1988. A new certificate of approval was issued in June 1988, with stricter effluent limitations. Fifty percent of the manufacturing operation has also been shut down.

Fleet Manufacturing has segregated their process wastes and discharges to the sanitary sewer. An extensive program is underway to define the groundwater contamination problem that exists at this facility. A proposal for remediation may include a french drain installed to collect groundwater and treatment by a Granular Activated Carbon (GAC) system. The program also aims to identify the source of the contamination.

The control program to hook up McMaster Avenue sewer to the Welland (River Road) WPCP has been completed in September 1989.

Upgrading of the facilities is taking place at the Welland (River Road) WPCP and Fort Erie (Anger Ave.) WPCP. Capacity is being expanded at the Welland WPCP in addition to the installation of effluent filtration, which will make this a tertiary plant. Secondary treatment is being installed at the Fort Erie WPCP plant.

There have been no modifications at the remaining significant point source facilities in the Niagara River drainage basin, namely Cyanamid of Canada - Niagara Falls Plant and Niagara Falls (Stamford) WPCP.

CONCLUSION

Industrial and Municipal Point Source effluent monitoring data were evaluated for the eight significant Ontario dischargers to the Niagara River for the 1987-1988 and 1988-1989 sampling periods. Results indicate a total load of toxic chemicals for these two periods of 30 kg/d and 22 kg/d respectively.

Calculations of the reductions in toxic chemical loadings are made using the Niagara River Toxics Committee baseline data (1981-1982) and the 1986-1987 data from the previous status report "Update Report, Priority Chemical Loadings from Ontario Point Sources Discharging To The Niagara River 1981 to 1987. The eight significant point sources show an overall load reduction to the Niagara River of 80% or 122 kg/d between 1981/82 and 1987/88 and 86% or 131 kg/d between 1981-1982 and 1988-1989. Comparing the data from the past two sampling years with the 1986/87 data, reductions of 50% (31 kg/d) and 64% (39 kg/d) were achieved.

Further reductions in total loadings to the river are expected with the implementation of the MISA program once both the monitoring and effluent limit regulations are put in place.

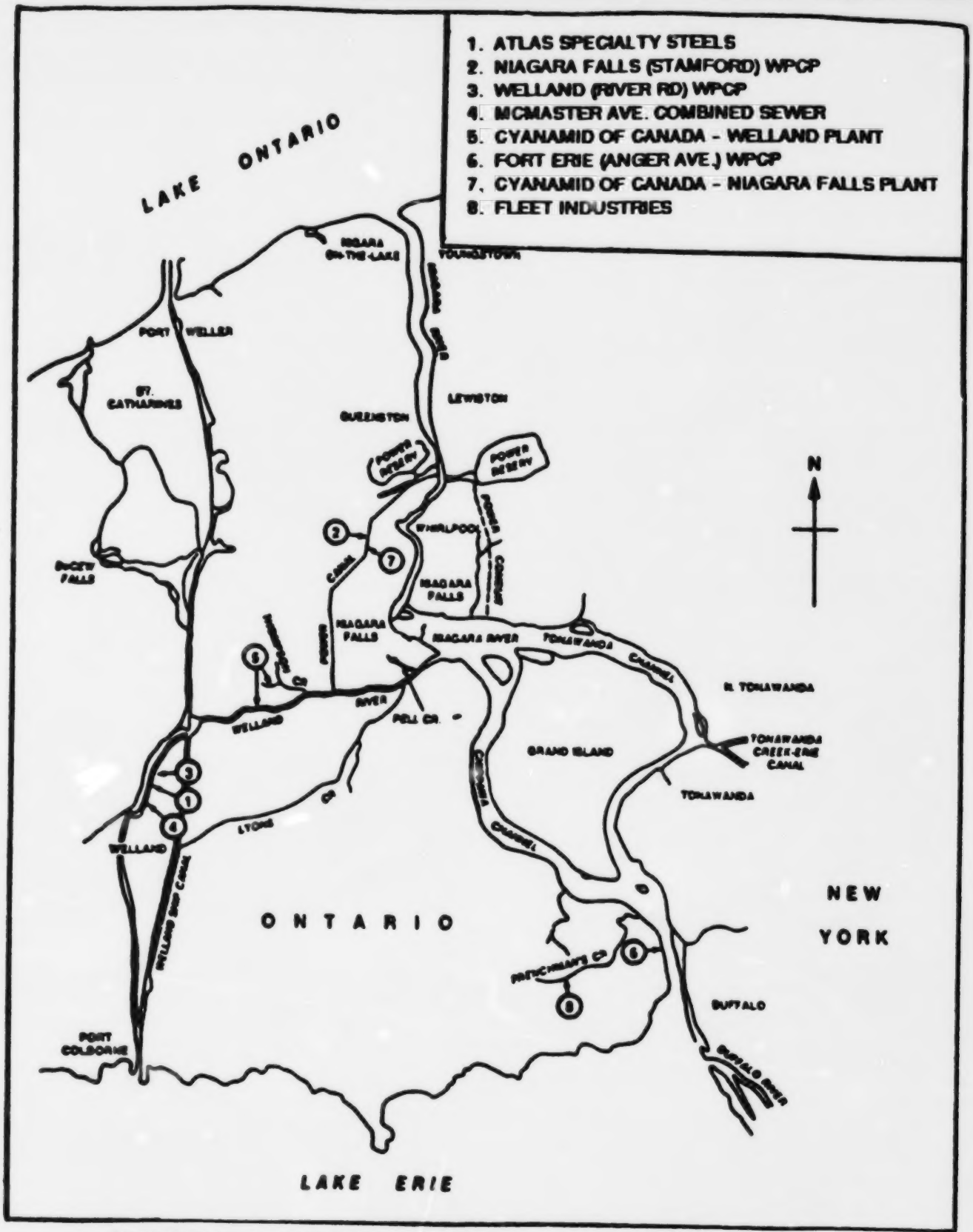

FIGURE 1: LOCATION OF EIGHT SIGNIFICANT CANADIAN POINT SOURCES TO THE NIAGARA RIVER

TABLE 4
PRIORITY POLLUTANTS DISCHARGED INTO THE NIAGARA RIVER
FROM ATLAS SPECIALTY STEELS
WELLAND, ONTARIO
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.0	0.0	0.0	N/A	0.0	0.024	0.028
Polynuclear Aromatics	0.014	0.0	0.0	N/A	0.335	0.0	0.0
PCB's	0.0	0.0	0.004	N/A	0.0	0.0	0.0
Pesticides	0.005	0.0	0.0	N/A	0.0	0.0	0.0
Other Base/Neutral Extractables	0.535	0.0	0.028	N/A	0.057	0.0	0.0
Volatile Compounds	3.178	0.170	0.579	N/A	0.164	0.019	0.002
Subtotal	3.732	0.170	0.611	N/A	0.556	0.043	0.03
INORGANICS							
Cyanides	0.0	0.178	0.0	N/A	0.028	0.292	0.552
Metals	70.475	13.257	15.706	18.598	12.557	6.708	8.594
Subtotal	70.475	13.435	15.706	N/A	12.585	7	9.146
TOTAL	74.207	13.605	16.317	N/A	13.141	7.043	9.176

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	98.8	92.3	99.2	94.6
INORGANICS (subtotal)	90.1	44.4	87.0	27.3
TOTAL	90.5	46.4	87.6	30.2

TABLE 5
PRIORITY POLLUTANTS DISCHARGED INTO THE NIAGARA RIVER
FROM CYANAMID OF CANADA - WELLAND PLANT
NIAGARA FALLS, ONTARIO
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.0	0.0	0.0	N/A	0.0	0.015	0.0
Polynuclear Aromatics	0.017	0.0	0.0	N/A	0.0	0.0	0.0
PCB's	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pesticides	0.003	0.0	0.0	0.0	0.0	0.0	0.0
Other Base/Neutral Extractables	0.283	0.212	0.077	N/A	0.0	0.0	0.0
Volatile Compounds	0.354	0.008	0.230	0.025	0.141	0.0	0.001
Subtotal	0.657	0.220	0.307	N/A	0.141	0.015	0.001
INORGANICS							
Cyanides	2.285	0.536	5.533	0.904	1.230	0.507	0.160
Metals	9.965	4.655	8.552	27.309	1.754	1.003	0.168
Subtotal	12.250	5.191	14.085	28.213	2.984	1.510	0.328
TOTAL	12.907	5.411	14.392	N/A	3.125	1.525	0.329

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	97.7	89.4	99.8	99.3
INORGANICS (subtotal)	87.6	49.4	97.3	89.0
TOTAL	88.2	51.2	97.5	89.5

TABLE 6
PRIORITY POLLUTANTS DISCHARGED INTO THE NIAGARA RIVER
FROM CYANAMID OF CANADA - NIAGARA PLANT
NIAGARA FALLS, ONTARIO
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.0	0.0	0.0	N/A	0.0	0.0	0.0
Polynuclear Aromatics	0.0	0.0	0.0	N/A	0.002	0.329	0.0
PCB's	0.0	0.0	0.0	N/A	0.0	0.0	0.0
Pesticides	0.003	0.0	0.0	N/A	0.0	0.001	0.001
Other Base/Neutral Extractables	0.693	0.0	0.0	N/A	0.090	0.0	0.0
Volatile Compounds	0.045	0.0	0.015	N/A	0.011	0.013	0.007
Subtotal	0.741	0.0	0.015	N/A	0.103	0.343	0.008
INORGANICS							
Cyanides	0.958	4.644	0.166	0.205	0.760	0.480	0.130
Metals	0.732	4.381	1.621	2.160	0.370	1.468	0.238
Subtotal	1.690	9.025	1.787	2.365	1.130	1.948	0.368
TOTAL	2.431	9.025	1.802	N/A	1.233	2.291	0.376

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	93.7	-233.0	98.9	92.2
INORGANICS (subtotal)	-15.3	-72.4	78.2	67.4
TOTAL	5.8	-85.8	84.5	69.5

TABLE 7
PRIORITY POLLUTANTS DISCHARGED INTO THE NIAGARA RIVER
FROM FLEET MANUFACTURING
FORT ERIE, ONTARIO
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.0	0.0	0.0	N/A	0.0	0.0	0.004
Polynuclear Aromatics	0.001	0.0	0.0	N/A	0.0	0.0	0.0
PCB's	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pesticides	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Base/Neutral Extractables	0.020	0.004	0.008	N/A	0.009	0.014	0.0
Volatile Compounds	0.054	0.014	0.064	0.311	0.082	0.013	0.012
Subtotal	0.075	0.018	0.072	N/A	0.091	0.027	0.016
INORGANICS							
Cyanides	0.0	0.010	0.004	0.004	0.0	0.0	0.001
Metals	1.198	0.416	0.806	0.948	0.105	0.092	0.078
Subtotal	1.198	0.426	0.810	0.952	0.105	0.092	0.079
TOTAL	1.273	0.444	0.882	N/A	0.196	0.119	0.095

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	64.0	70.3	78.7	82.4
INORGANICS (subtotal)	92.3	12.4	93.4	24.8
TOTAL	90.7	39.3	92.5	51.5

TABLE 8
PRIORITY POLLUTANTS DISCHARGED INTO THE NIAGARA RIVER
FROM NIAGARA FALLS (STAMFORD) WPCP
NIAGARA FALLS, ONTARIO
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.404	0.490	0.062	N/A	0.0	0.282	0.712
Polynuclear Aromatics	0.083	0.0	0.056	N/A	0.025	0.0	0.0
PCB's	0.0	0.0	0.002	0.0	0.001	0.0	0.0
Pesticides	0.017	0.0	0.005	0.0	0.003	0.003	0.004
Other Base/Neutral Extractables	4.490	3.615	0.713	N/A	0.436	0.673	0.284
Volatile Compounds	1.073	1.409	9.562	1.198	0.527	0.465	0.988
Subtotal	6.067	5.514	10.400	N/A	0.992	1.423	1.988
INORGANICS							
Cyanides	0.340	0.006	1.452	1.255	0.215	0.352	0.209
Metals	17.118	5.321	3.539	7.992	2.393	1.226	1.589
Subtotal	17.458	5.327	4.991	9.247	2.608	1.578	1.798
TOTAL	23.525	10.841	15.391	N/A	3.600	3.001	3.786

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	76.5	-43.4	67.2	-100.4
INORGANICS (subtotal)	91.0	39.5	89.7	31.1
TOTAL	87.2	16.6	83.9	-5.2

TABLE 9
PRIORITY POLLUTANTS DISCHARGED INTO THE NIAGARA RIVER
FROM WELLAND (RIVER ROAD) WPCP
WELLAND, ONTARIO
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.041	0.0	0.0	N/A	0.0	0.154	0.157
Polynuclear Aromatics	0.067	0.0	0.0	N/A	0.001	0.0	0.0
PCB's	0.006	0.0	0.0	0.0	0.0	0.0	0.0
Pesticides	0.011	0.001	0.001	0.0	0.002	0.001	0.002
Other Base/Neutral Extractables	0.129	0.878	0.042	N/A	0.643	0.0	0.0
Volatile Compounds	0.313	1.512	1.003	N/A	0.288	0.141	0.097
Subtotal	0.567	2.391	1.046	N/A	0.934	0.295	0.256
INORGANICS							
Cyanides	0.160	0.001	0.109	0.108	0.126	0.058	0.097
Metals	16.494	3.551	0.133	2.870	2.221	1.252	3.260
Subtotal	16.654	3.552	0.242	2.978	2.347	1.310	3.357
TOTAL	17.221	5.943	1.288	N/A	3.281	1.605	3.613

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	48.0	68.4	54.9	72.6
INORGANICS (subtotal)	92.1	44.2	79.8	-43.0
TOTAL	90.7	51.1	79.0	-10.1

TABLE 10
PRIORITY POLLUTANTS DISCHARGED INTO THE NIAGARA RIVER
FROM FORT ERIE (ANGER AVE.) WPCP
FORT ERIE, ONTARIO
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.012	0.014	0.0	N/A	0.240	0.541	1.216
Polynuclear Aromatics	0.055	0.028	0.0	N/A	0.030	0.0	0.002
PCB's	0.0	0.0	0.001	0.0	0.0	0.0	0.0
Pesticides	0.005	0.001	0.0	0.0	0.001	0.001	0.001
Other Base/Neutral Extractables	2.221	3.168	4.887	N/A	31.412	10.921	0.792
Volatile Compounds	2.771	2.225	0.273	0.985	1.613	0.428	0.374
Subtotal	5.064	5.436	5.161	N/A	33.296	11.891	2.385
INORGANICS							
Cyanides	0.098	0.0	0.180	0.130	0.090	0.324	0.062
Metals	1.972	1.161	0.301	1.426	1.103	0.573	0.534
Subtotal	2.070	1.161	0.481	1.556	1.193	0.897	0.596
TOTAL	7.134	6.597	5.642	N/A	34.489	12.786	2.981

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	-134.8	84.3	52.9	92.8
INORGANICS (subtotal)	56.7	24.8	71.2	50.0
TOTAL	-79.2	-62.9	58.2	91.4

TABLE 11
PRIORITY POLLUTANTS DISCHARGED INTO THE NIAGARA RIVER
FROM MCMASTER COMBINED SEWER
WELLAND, ONTARIO
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.0	0.0	0.029	N/A	0.022	0.045	0.487
Polynuclear Aromatics	0.008	0.0	0.0	N/A	0.009	0.123	0.0
PCB's	0.0	N/A	0.0	N/A	0.0	0.0	0.0
Pesticides	0.001	N/A	0.0	N/A	0.0	0.001	0.001
Other Base/Neutral Extractables	0.611	0.0	0.029	N/A	0.382	0.334	0.146
Volatile Compounds	0.115	0.0	0.220	0.300	0.168	0.131	0.125
Subtotal	0.735	N/A	0.278	N/A	0.581	0.634	0.759
INORGANICS							
Cyanides	0.0	0.009	0.0	0.0	0.001	0.004	0.016
Metals	13.080	2.185	2.912	N/A	1.142	1.212	2.097
Subtotal	13.080	2.194	2.912	N/A	1.143	1.216	2.113
TOTAL	13.815	N/A	3.190	N/A	1.724	1.850	2.872

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	13.7	-9.1	-3.3	-30.6
INORGANICS (subtotal)	90.7	-6.4	83.8	-84.9
TOTAL	86.6	-7.3	79.2	-66.6

TABLE 12
PRIORITY POLLUTANTS DISCHARGED TO THE NIAGARA RIVER FROM ONTARIO SIGNIFICANT INDUSTRIAL AND MUNICIPAL FACILITIES
(by Analytical Category)

Contaminant Group	Loading to Niagara River (Kg/day)						
	1981/1982	1983	1984	1985	1986/1987	1987/1988	1988/1989
ORGANICS							
Acid Extractables	0.457	0.504	0.091	N/A	0.262	1.061	1.226
Polynuclear Aromatics	0.245	0.028	0.056	N/A	0.402	0.452	0.002
PCB's	0.006	N/A	0.007	N/A	0.001	0.0	0.0
Pesticides	0.045	N/A	0.006	N/A	0.006	0.007	0.009
Other Base/Neutral Extractables	8.982	7.877	5.784	N/A	33.029	11.942	1.222
Volatile Compounds	7.903	5.338	11.946	N/A	2.994	1.210	1.606
Subtotal	17.638	N/A	17.890	N/A	36.694	14.671	4.065
INORGANICS							
Cyanides	3.841	5.384	7.444	N/A	2.450	2.017	1.197
Metals	131.034	34.927	33.570	N/A	21.645	13.534	16.558
Subtotal	134.875	40.311	41.014	N/A	24.095	15.551	17.755
TOTAL	152.513	N/A	58.904	N/A	60.789	30.222	21.820

REDUCTIONS

Contaminant Group	Percent Reduction (81/82 to 87/88)	Percent Reduction (86/87 to 87/88)	Percent Reduction (81/82 to 88/89)	Percent Reduction (86/87 to 88/89)
ORGANICS (subtotal)	16.8	60.0	77.0	88.9
INORGANICS (subtotal)	88.5	35.5	86.8	26.3
TOTAL	80.2	50.3	85.7	64.1

TABLE 13
ATLAS SPECIALTY STEELS DIVISION
PRIORITY POLLUTANT LOADINGS
1987/1988 Niagara River Improvement Project Survey
FLOW = 36460 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			6.7084
silver	0.0729		
arsenic	1.9688	*	
chromium	0.6563	*	
copper	0.8750	*	
nickel	0.8750	*	
lead	0.8021	*	
zinc	1.4583	*	
TOTAL PHENOLICS (4AAP)	0.0237		0.0237
CYANIDE	0.2917	*	0.2917
VOLATILE ORGANICS			0.0189
1,1,1 trichloroethane	0.0153		
trichloroethylene	0.0036		
EXTRACTABLE ORGANICS			
none detected			
OC PESTICIDES AND PCB's			
none detected			
TOTAL PRIORITY POLLUTANT LOADING			7.0427

NOTE: "*" indicates values above cut-off levels

TABLE 14
ATLAS SPECIALTY STEELS DIVISION
PRIORITY POLLUTANT LOADINGS
1988/1989 Niagara River Improvement Project Survey
FLOW = 26280 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			8.5940
arsenic	0.4731	*	
chromium	1.3141	*	
copper	1.0512	*	
nickel	1.3929	*	
lead	0.9987	*	
zinc	3.3640	*	
TOTAL PHENOLICS (4AAP)	0.0276		0.0276
CYANIDE	0.5519	*	0.5519
VOLATILE ORGANICS			0.0020
1,1,1 trichloroethane	0.0013		
trichloroethylene	0.0007		
EXTRACTABLE ORGANICS			
none detected			
OC PESTICIDES AND PCB's			
none detected			
TOTAL PRIORITY POLLUTANT LOADING			9.1755

NOTE: "*" indicates values above cut-off levels

TABLE 15
CYANAMID OF CANADA - WELLAND PLANT
PRIORITY POLLUTANT LOADINGS
1987/1988 Niagara River Improvement Project Survey
FLOW = 21120 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			1.0032
copper	0.2112		
lead	0.4224		
zinc	0.3696		
TOTAL PHENOLICS (4AAP)	0.0148		0.0148
CYANIDE	0.5069	*	0.5069
VOLATILE ORGANICS			
none detected			
EXTRACTABLE ORGANICS			
none detected			
OC PESTICIDES AND PCB's			
none detected			
TOTAL PRIORITY POLLUTANT LOADING			1.5249

NOTE: "*" indicates values above cut-off levels

TABLE 16
CYANAMID OF CANADA - WELLAND PLANT
PRIORITY POLLUTANT LOADINGS
1988/1989 Niagara River Improvement Project Survey
FLOW = 13680 m3/day

PARAMETER	LOADING (kg/day)	TOTAL LOADING (kg/day)
METALS		0.1683
chromium	0.0137	
copper	0.0410	
nickel	0.0315	
zinc	0.0821	
TOTAL PHENOLICS (4AAP)	not detected	
CYANIDE	0.1601	0.1601
VOLATILE ORGANICS		0.0009
benzene	0.0009	
EXTRACTABLE ORGANICS		
none detected		
OC PESTICIDES AND PCB's		
none detected		
TOTAL PRIORITY POLLUTANT LOADING		0.3293

NOTE: "*" indicates values above cut-off levels

TABLE 17
CYANAMID OF CANADA - NIAGARA FALLS PLANT
PRIORITY POLLUTANT LOADINGS
1987/1988 Niagara River Improvement Project Survey
FLOW = 32400 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			1.4675
cadmium	0.0198		
chromium	0.1476		
copper	0.4932	*	
mercury	0.0005		
nickel	0.0360		
lead	0.2268		
zinc	0.5436	*	
TOTAL PHENOLICS (4AAP)	not detected		
CYANIDE	0.4800	*	0.4800
VOLATILE ORGANICS			0.0134
chloroform	0.0046		
tetrachloroethylene	0.0004		
benzene	0.0010		
1,2 dichlorobenzene	0.0018		
toluene	0.0056		
EXTRACTABLE ORGANICS			0.3288
chrysene	0.0048		
fluoranthene	0.0518		
pyrene	0.2722	*	
OC PESTICIDES AND PCB's			0.0005
a-BHC	0.000036		
methoxychlor	0.000360		
endrin	0.000050		
o,p-DDT	0.000027		
p,p-DDD	0.000045		
TOTAL PRIORITY POLLUTANT LOADING			2.2902

NOTE: "*" indicates values above cut-off levels

TABLE 18
CYANAMID OF CANADA - NIAGARA FALLS PLANT
PRIORITY POLLUTANT LOADINGS
1988/1989 Niagara River Improvement Project Survey
FLOW = 32400 m3/day

PARAMETER	LOADING (kg/day)	TOTAL LOADING (kg/day)
METALS		0.2376
chromium	0.0432	
lead	0.1447	
zinc	0.0497	
TOTAL PHENOLICS (4AAP)	not detected	
CYANIDE	0.1296	0.1296
VOLATILE ORGANICS		0.0072
chloroform	0.0072	
EXTRACTABLE ORGANICS		
none detected		
OC PESTICIDES AND PCB's		0.0001
a-BHC	0.000153	

TOTAL PRIORITY POLLUTANT LOADING 0.3745

NOTE: "*" indicates values above cut-off levels

TABLE 19
FLEET MANUFACTURING
PRIORITY POLLUTANT LOADINGS
1987/1988 Niagara River Improvement Project Survey
FLOW = 915 m3/day

PARAMETER	LOADING (kg/day)	TOTAL LOADING (kg/day)
METALS		0.0919
cadmium	0.0006	
chromium	0.0187	
copper	0.0030	
mercury	0.0001	
nickel	0.0019	
lead	0.0095	
zinc	0.0581	
TOTAL PHENOLICS (4AAP)	0.0006	0.0006
CYANIDE	not detected	
VOLATILE ORGANICS		0.0130
methylene chloride	0.0055	
1,1 dichloroethane	0.0001	
1,1,1 trichloroethane	0.0012	
1,1 dichloroethylene	0.0003	
trans-1,2 dichloroethylene	0.0011	
trichloroethylene	0.0045	
tetrachloroethylene	0.0001	
benzene	0.0001	
toluene	0.0001	
EXTRACTABLE ORGANICS		0.0137
di-n-octyl phthalate	0.0137	
OC PESTICIDES AND PCB's		
none detected		
TOTAL PRIORITY POLLUTANT LOADING		0.1192

NOTE: "*" indicates values above cut-off levels

TABLE 20
FLEET MANUFACTURING
PRIORITY POLLUTANT LOADINGS
1988/1989 Niagara River Improvement Project Survey
FLOW = 630 m3/day

PARAMETER	LOADING (kg/day)	TOTAL LOADING (kg/day)
METALS		0.0775
arsenic	0.0003	
chromium	0.0325	
copper	0.0076	
nickel	0.0013	
lead	0.0028	
zinc	0.0330	
TOTAL PHENOLICS (4AAP)	0.0035	0.0035
CYANIDE	0.0010	0.0010
VOLATILE ORGANICS		0.0121
methylene chloride	0.0021	
1,1 dichloroethane	0.0001	
1,1,1 trichloroethane	0.0015	
chloroethylene	0.0001	
1,1 dichloroethylene	0.0003	
trans-1,2 dichloroethylene	0.0017	
trichloroethylene	0.0059	
tetrachloroethylene	0.0003	
toluene	0.0001	
EXTRACTABLE ORGANICS		
none detected		
OC PESTICIDES AND PCB's		
none detected		
TOTAL PRIORITY POLLUTANT LOADING		0.0941

NOTE: "*" indicates values above cut-off levels

TABLE 21
NIAGARA FALLS (STAMFORD) WPCP
PRIORITY POLLUTANT LOADINGS
1987/1988 Niagara River Improvement Project Survey
FLOW = 61210 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			1.2260
copper	0.6121	*	
mercury	0.0018		
zinc	0.6121	*	
TOTAL PHENOLICS (4AAP)	0.2265	*	0.2265
CYANIDE	0.3520	*	0.3520
VOLATILE ORGANICS			0.4652
methylene chloride	0.2647	*	
chloroform	0.1913		
benzene	0.0015		
1,2 dichlorobenzene	0.0046		
toluene	0.0031		
EXTRACTABLE ORGANICS			0.7286
butoxyethoxyethanol	0.6733	*	
phenol	0.0551		
OC PESTICIDES AND PCB's			0.0026
g-BHC	0.002372		
hexachlorobenzene	0.000199		
TOTAL PRIORITY POLLUTANT LOADING			3.0007

NOTE: "*" indicates values above cut-off levels

TABLE 22
NIAGARA FALLS (STAMFORD) WPCP
PRIORITY POLLUTANT LOADINGS
1988/1989 Niagara River Improvement Project Survey
FLOW = 55730 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			1.5892
chromium	0.1951		
copper	0.8360	*	
mercury	0.0008		
zinc	0.5573	*	
TOTAL PHENOLICS (4AAP)	0.6688	*	0.6688
CYANIDE	0.2090		0.2090
VOLATILE ORGANICS			0.9879
1,1 dichloroethylene	0.0557		
methylene chloride	0.2090		
chloroform	0.3829	*	
tetrachloroethylene	0.0425		
toluene	0.2978	*	
EXTRACTABLE ORGANICS			0.3262
bis (2-ethylhexyl) phthalate	0.2837	*	
m-cresol	0.0425		
OC PESTICIDES AND PCB's			0.0040
b-BHC	0.002269		
g-BHC	0.001404		
g-chlordane	0.000369		
TOTAL PRIORITY POLLUTANT LOADING			3.7851

NOTE: "*" indicates values above cut-off levels

TABLE 23
WELLAND (RIVER ROAD) WPCP
PRIORITY POLLUTANT LOADINGS
1987/1988 Niagara River Improvement Project Survey
FLOW = 28890 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			1.2522
silver	0.1926		
chromium	0.1926		
mercury	0.0004		
zinc	0.8666	*	
TOTAL PHENOLICS (4AAP)	0.1541		0.1541
CYANIDE	0.0578		0.0578
VOLATILE ORGANICS			0.1407
methylene chloride	0.0818		
chloroform	0.0501		
chlorodibromomethane	0.0010		
dichlorobromomethane	0.0029		
benzene	0.0010		
1,3 dichlorobenzene	0.0029		
toluene	0.0010		
EXTRACTABLE ORGANICS			
none detected			
OC PESTICIDES AND PCB's			0.0013
a-BHC	0.000036		
g-BHC	0.001252		
TOTAL PRIORITY POLLUTANT LOADING			1.6061

NOTE: "*" indicates values above cut-off levels

TABLE 24
WELLAND (RIVER ROAD) WPCP
PRIORITY POLLUTANT LOADINGS
1988/1989 Niagara River Improvement Project Survey
FLOW = 32170 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			3.2597
silver	0.2145		
chromium	0.8685	*	
copper	0.2681		
zinc	1.9086	*	
TOTAL PHENOLICS (4AAP)	0.1565		0.1565
CYANIDE	0.0965		0.0965
VOLATILE ORGANICS			0.0965
1,1 dichloroethylene	0.0032		
1,1 dichloroethane	0.0032		
1,1,1 trichloroethane	0.0032		
carbon tetrachloride	0.0032		
trichloroethylene	0.0032		
toluene	0.0708		
tetrachloroethylene	0.0032		
1,3 dichlorobenzene	0.0064		
EXTRACTABLE ORGANICS			
none detected			
OC PESTICIDES AND PCB's			0.0018
a-BHC	0.000268		
g-BHC	0.001179		
g-chlordane	0.000247		
hexachlorobenzene	0.000150		
TOTAL PRIORITY POLLUTANT LOADING			3.6110

NOTE: "*" indicates values above cut-off levels

TABLE 25
FT. ERIE (ANGER AVENUE) WPCP
PRIORITY POLLUTANT LOADINGS
1987/1988 Niagara River Improvement Project Survey
FLOW = 7310 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			0.5728
chromium	0.0197		
copper	0.1185		
mercury	0.0003		
nickel	0.0592		
lead	0.1777		
zinc	0.1974		
TOTAL PHENOLICS (4AAP)	0.0904		0.0904
CYANIDE	0.3238	*	0.3238
VOLATILE ORGANICS			0.4284
methylene chloride	0.1502		
chloroform	0.0941		
chlorodibromomethane	0.0062		
dichlorobromomethane	0.0041		
1,1,1 trichloroethane	0.0068		
tetrachloroethylene	0.0882		
benzene	0.0062		
chlorobenzene	0.0021		
1,2 dichlorobenzene	0.0186		
1,3 dichlorobenzene	0.0155		
ethylbenzene	0.0010		
toluene	0.0354		
EXTRACTABLE ORGANICS			11.3716
dimethyl phthalate	10.8351	*	
diethyl phthalate	0.0474		
dibutyl phthalate	0.0082		
di-n-octyl phthalate	0.0210		
bis (2-ethylhexyl) phthalate	0.0091		
phenol	0.0393		
2,4 dichlorophenol	0.0037		
4-nitrophenol	0.0018		
o-cresol	0.3061	*	
m-cresol	0.0999		
OC PESTICIDES AND PCB's			0.0004
a-BHC	0.000059		

b-BHC	0.000038
g-BHC	0.000233
a-chlordane	0.000016
g-chlordane	0.000026
heptachlor	0.000043
hexachlorobenzene	0.000012

TOTAL PRIORITY POLLUTANT LOADING 12.7864

NOTE: "*" indicates values above cut-off levels

TABLE 26
FT. ERIE (ANGER AVENUE) WPCP
PRIORITY POLLUTANT LOADINGS
1988/1989 Niagara River Improvement Project Survey
FLOW = 7770 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			0.5341
chromium	0.0056		
copper	0.1354		
mercury	0.0002		
lead	0.1665		
antimony	0.0044		
zinc	0.2220		
TOTAL PHENOLICS (4AAP)	0.4590		0.4590
CYANIDE	0.0622		0.0622
VOLATILE ORGANICS			0.3741
methylene chloride	0.1209	*	
chloroform	0.0344		
chlorodibromomethane	0.0087		
dichlorobromomethane	0.0059		
1,1 dichloroethane	0.0060		
1,2 dichloroethane	0.0011		
1,1,1 trichloroethane	0.0424		
1,1 dichloroethylene	0.0051		
trichloroethylene	0.0006		
tetrachloroethylene	0.0381		
benzene	0.0058		
chlorobenzene	0.0003		
1,2 dichlorobenzene	0.0105		
1,3 dichlorobenzene	0.0033		
1,4 dichlorobenzene	0.0115		
ethylbenzene	0.0001		
toluene	0.0271		
chlorotoluene	0.0427		
o-xylene	0.0058		
m & p-xylene	0.0038		
EXTRACTABLE ORGANICS			1.5517
diethyl phthalate	0.4274	*	
dibutyl phthalate	0.1576	*	
bis (2-ethylhexyl) phthalate	0.0666		
butylbenzyl phthalate	0.1399		
naphthalene	0.0022		
1-methylnaphthalene	0.0002		

phenol	0.0344	
2,4,5 trichlorophenol	0.0002	
2,4,6 trichlorophenol	0.0013	
pentachlorophenol	0.0003	
o-cresol	0.2131	
m-cresol	0.1155	
p-cresol	0.3930	
OC PESTICIDES AND PCB's		0.0014
b-BHC	0.000343	
g-BHC	0.000940	
a-chlordane	0.000028	
g-chlordane	0.000036	
endrin	0.000011	
heptachlor	0.000044	
p,p-DDD	0.000006	
a-chlordane	0.000028	
endrin	0.000011	
TOTAL PRIORITY POLLUTANT LOADING		2.9823

NOTE: "*" indicates values above cut-off levels

TABLE 27
McMASTER AVENUE COMBINED SEWER
PRIORITY POLLUTANT LOADINGS
1987/1988 Niagara River Improvement Project Survey
FLOW = 4975 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			1.2123
silver	0.0100		
cadmium	0.0030		
chromium	0.0149		
copper	0.0746		
mercury	0.0002		
nickel	0.0199		
lead	0.0647		
thallium	0.0249		
zinc	1.0001	*	
TOTAL PHENOLICS (4AAP)	0.0027		0.0027
CYANIDE	0.0040		0.0040
VOLATILE ORGANICS			0.1309
dichloromethane	0.0104		
chloroform	0.0100		
chlorodibromomethane	0.0005		
dichlorobromomethane	0.0065		
dichlorodifluoromethane	0.0010		
1,1,1 trichloroethane	0.0005		
1,1 dichloroethylene	0.0005		
trans-1,2 dichloroethylene	0.0010		
trichloroethylene	0.0065		
tetrachloroethylene	0.0791		
benzene	0.0005		
1,2 dichlorobenzene	0.0104		
1,3 dichlorobenzene	0.0025		
toluene	0.0005		
o-xylene	0.0005		
m-xylene	0.0005		
EXTRACTABLE ORGANICS			0.5021
butoxyethoxyethanol	0.0846		
diethyl phthalate	0.0224		
dibutyl phthalate	0.0005		
di-n-octyl phthalate	0.0930		
bis (2-ethylhexyl) phthalate	0.1105		
butylbenzyl phthalate	0.0229		
naphthalene	0.0025		

1-methylnaphthalene	0.1204	
phenol	0.0035	
o-cresol	0.0413	
2,4-dichlorophenol	0.0005	
OC PESTICIDES AND PCB's		0.0003
a-BHC	0.000013	
b-BHC	0.000074	
g-BHC	0.000055	
Endosulphan I	0.000005	
Heptachlor	0.000026	
Oxychlordane	0.000029	
p,p-DDE	0.000055	
hexachlorobenzene	0.000003	
TOTAL PRIORITY POLLUTANT LOADING		1.8523

NOTE: "*" indicates values above cut-off levels

TABLE 28
McMASTER AVENUE COMBINED SEWER
PRIORITY POLLUTANT LOADINGS
1988/1989 Niagara River Improvement Project Survey
FLOW = 7971 m3/day

PARAMETER	LOADING (kg/day)		TOTAL LOADING (kg/day)
METALS			2.0966
silver	0.1036		
chromium	0.0797		
copper	0.1913		
mercury	0.0002		
nickel	0.0319		
lead	0.4225		
zinc	1.2674	*	
TOTAL PHENOLICS (4AAP)	0.0622		0.0622
CYANIDE	0.0159		0.0159
VOLATILE ORGANICS			0.1245
chloroform	0.0167		
chlorodibromomethane	0.0008		
dichlorobromomethane	0.0016		
1,2 dichloroethane	0.0016		
1,1,1 trichloroethane	0.0112		
1,1,2 trichloroethane	0.0008		
1,1 dichloroethylene	0.0064		
trichloroethylene	0.0040		
tetrachloroethylene	0.0327		
1,2 dichlorobenzene	0.0319		
1,4 dichlorobenzene	0.0064		
ethylbenzene	0.0008		
toluene	0.0032		
o-xylene	0.0024		
m/p-xylene	0.0040		
EXTRACTABLE ORGANICS			0.5710
phenol	0.0263		
bis (2-ethylhexyl) phthalate	0.1459		
m-cresol	0.0375		
o-cresol	0.0879		
p-cresol	0.2734	*	
OC PESTICIDES AND PCB's			0.0004
p,p-DDE	0.000008		
g-BHC	0.000359		
TOTAL PRIORITY POLLUTANT LOADING			2.8706

NOTE: "*" indicates values above cut-off levels

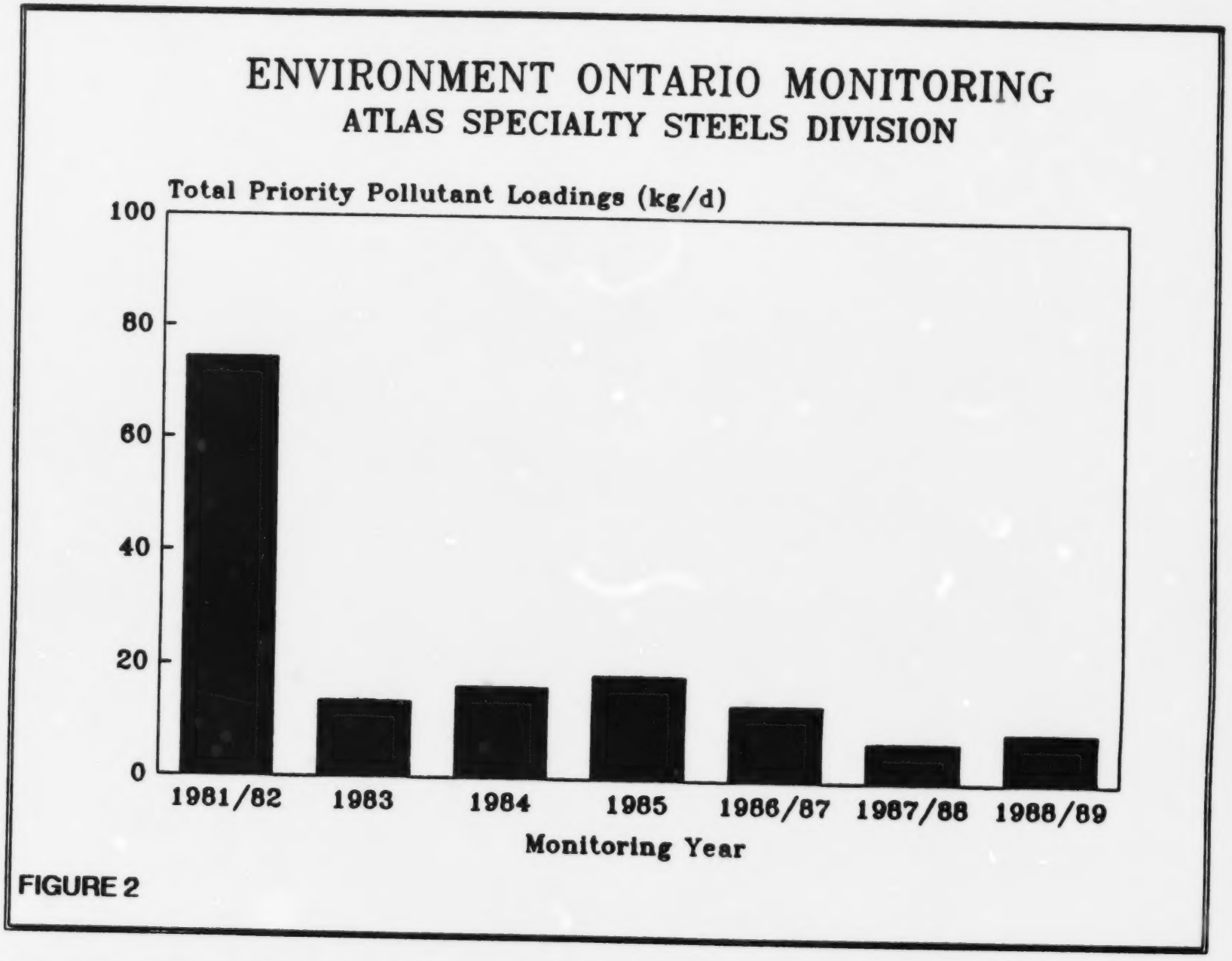
ENVIRONMENT ONTARIO MONITORING
ATLAS SPECIALTY STEELS DIVISION
Total Priority Pollutant Loadings (kg/d)
100
80
60
40
20
0
1981/82
1983
1984
1985
1986/87
1987/88
1988/89
Monitoring Year

FIGURE 2

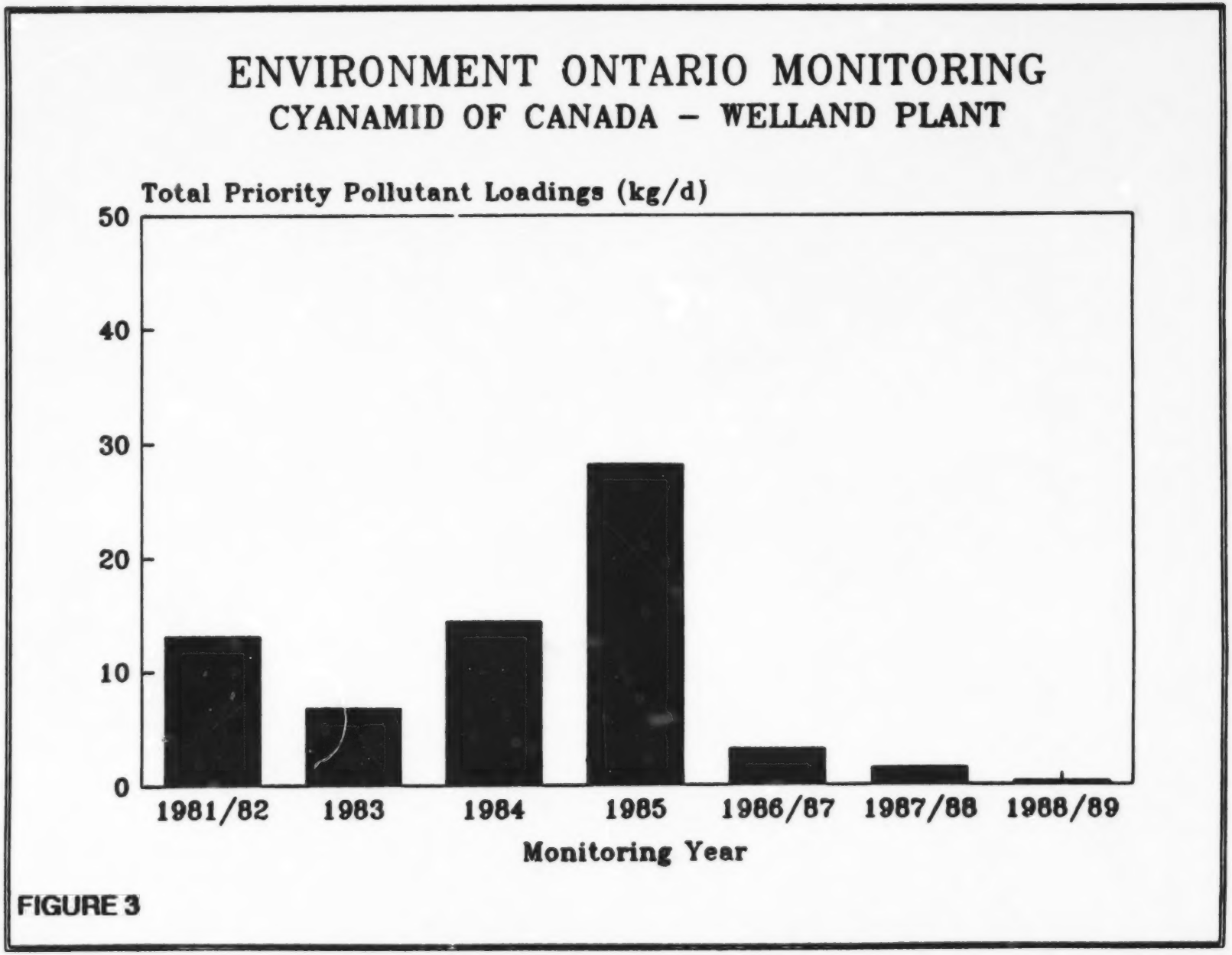
ENVIRONMENT ONTARIO MONITORING
CYANAMID OF CANADA - WELLAND PLANT
Total Priority Pollutant Loadings (kg/d)
50
40
30
20
10
0
1981/82
1983
1984
1985
1986/87
1987/88
1988/89
Monitoring Year

FIGURE 3

ENVIRONMENT ONTARIO MONITORING
CYANAMID OF CANADA – NIAGARA FALLS PLANT

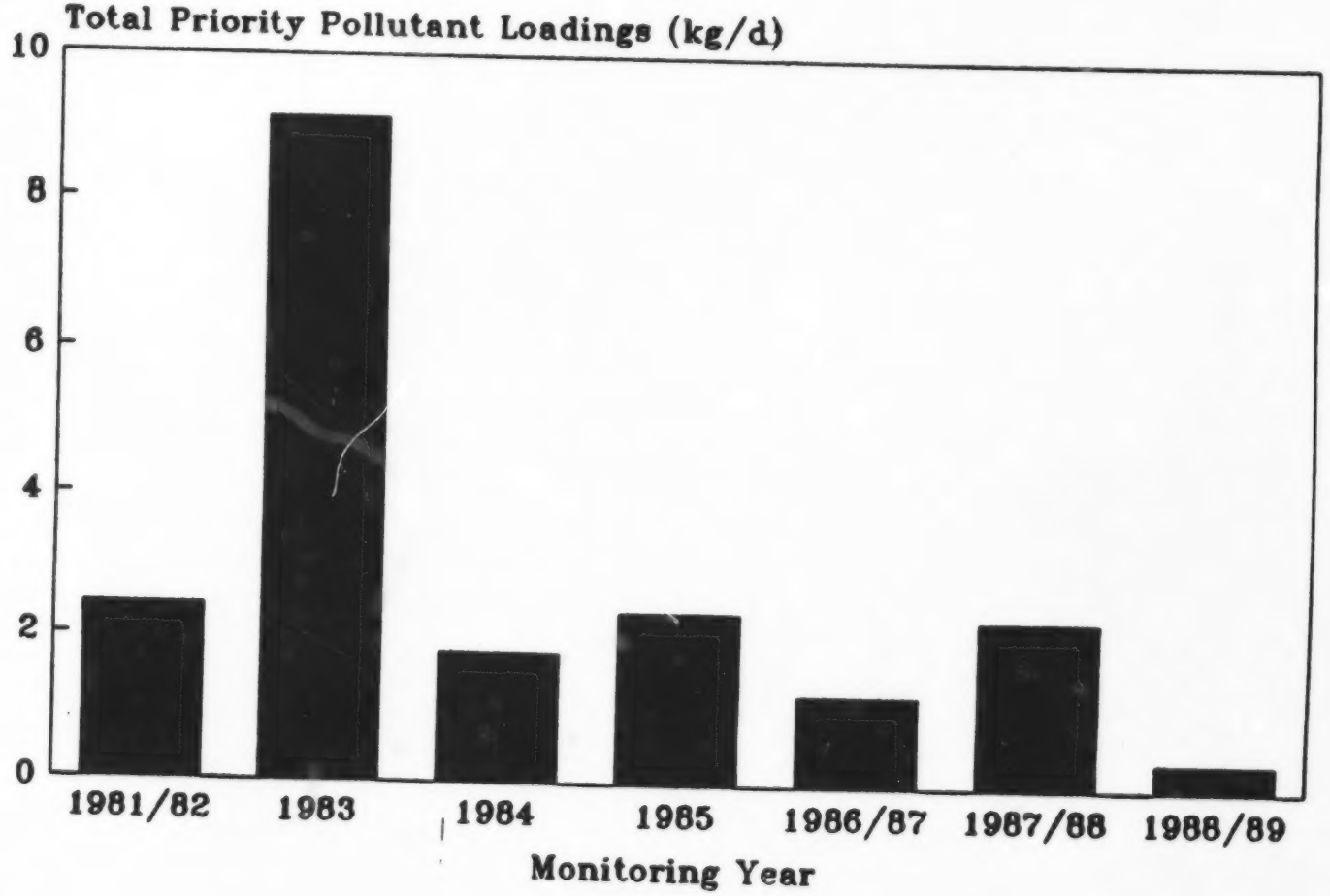

FIGURE 4

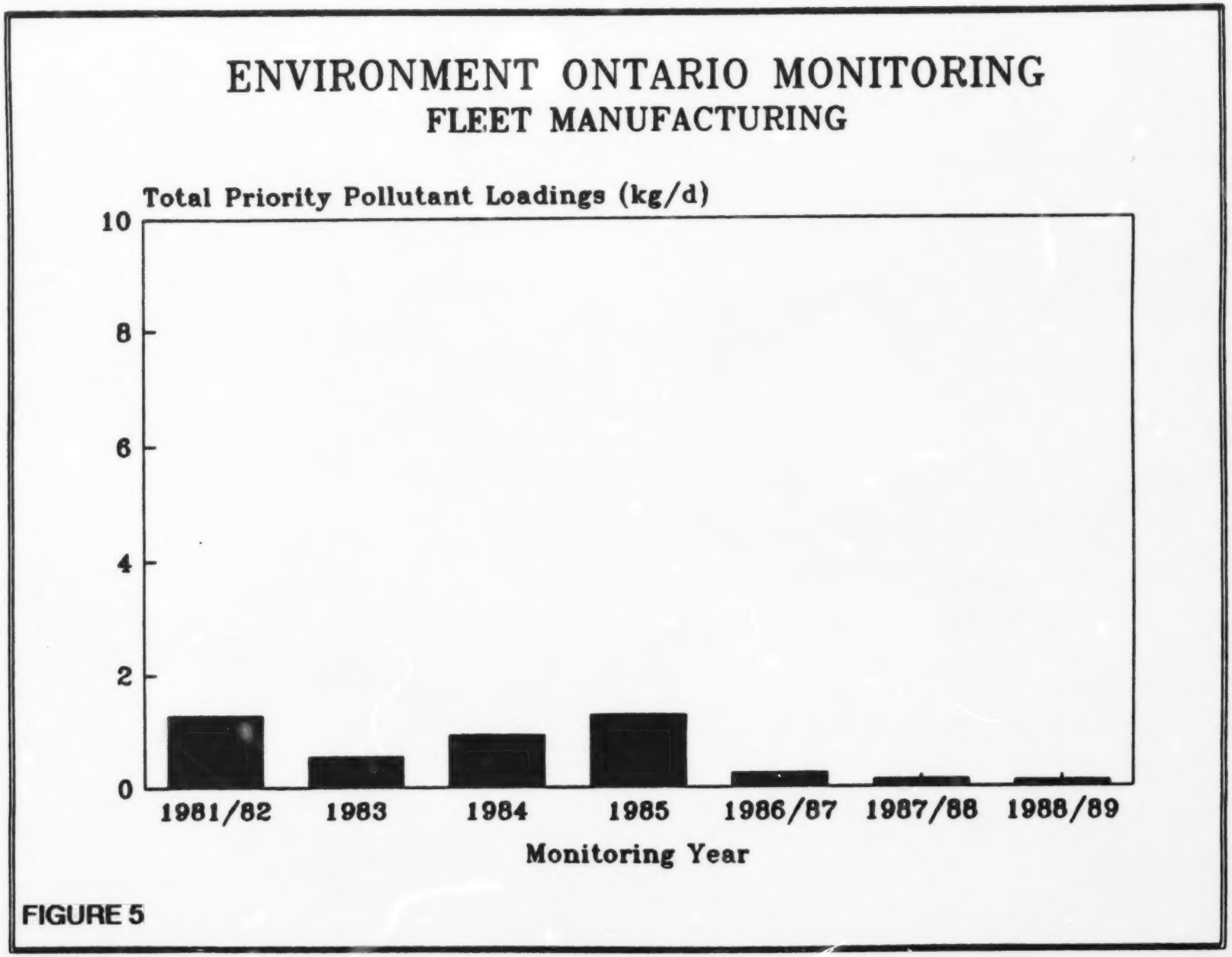
ENVIRONMENT ONTARIO MONITORING
FLEET MANUFACTURING
Total Priority Pollutant Loadings (kg/d)
10
8
6
4
2
0
1981/82
1983
1984
1985
1986/87
1987/88
1988/89
Monitoring Year

FIGURE 5

ENVIRONMENT ONTARIO MONITORING
NIAGARA FALLS (STAMFORD) WPCP

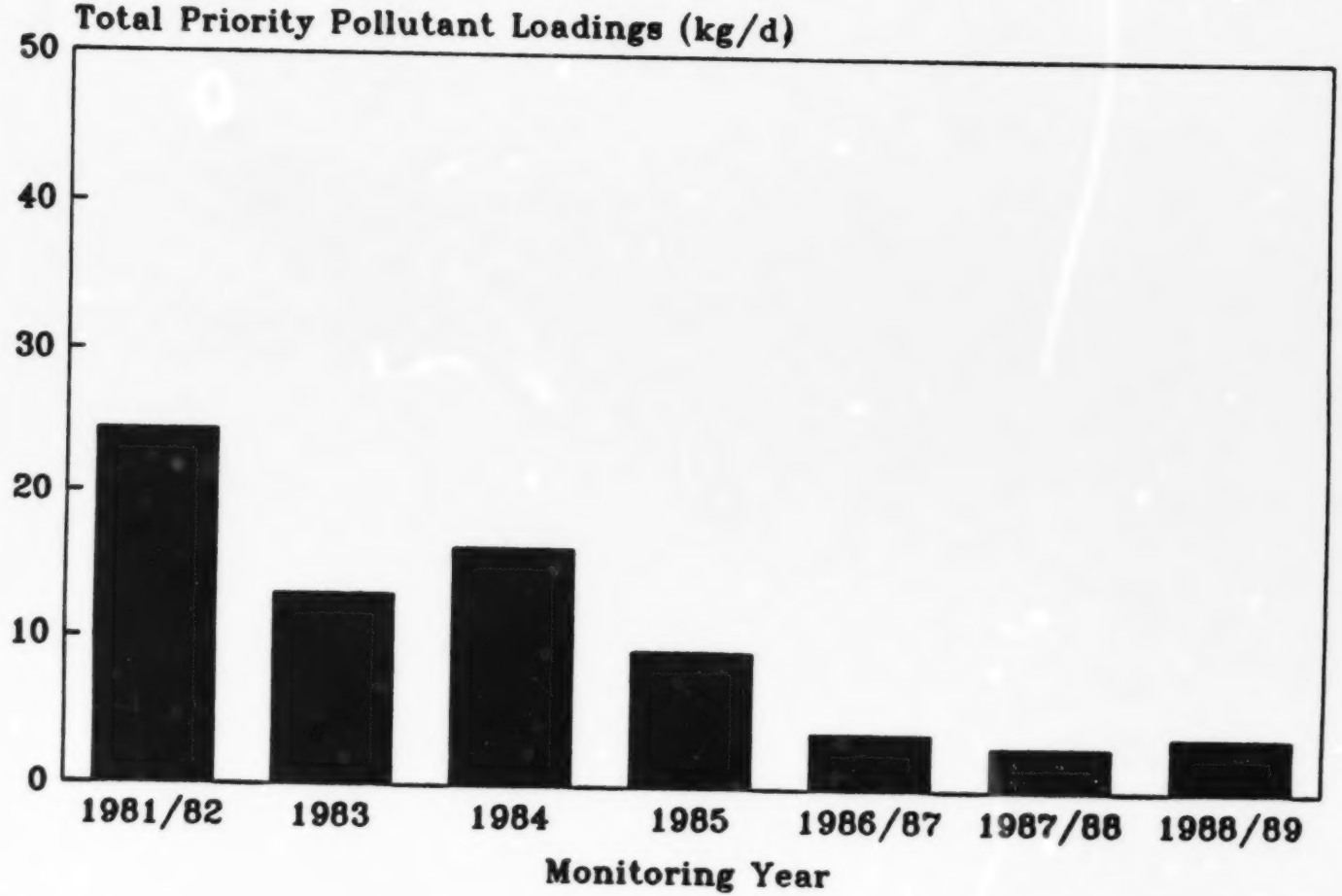

FIGURE 6

ENVIRONMENT ONTARIO MONITORING
WELLAND (RIVER ROAD) WPCP

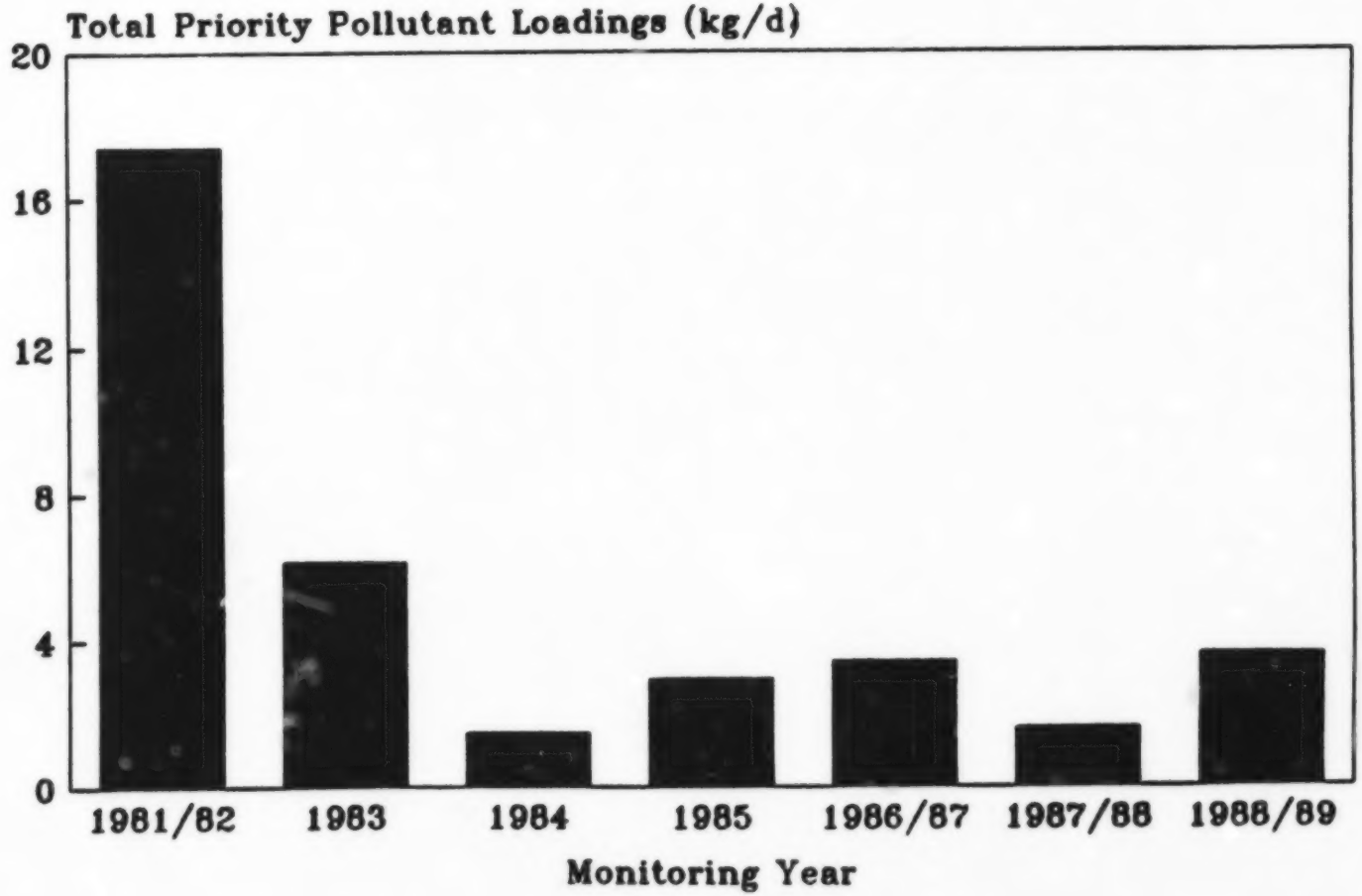

FIGURE 7

ENVIRONMENT ONTARIO MONITORING
FT. ERIE (ANGER AVENUE) WPCP

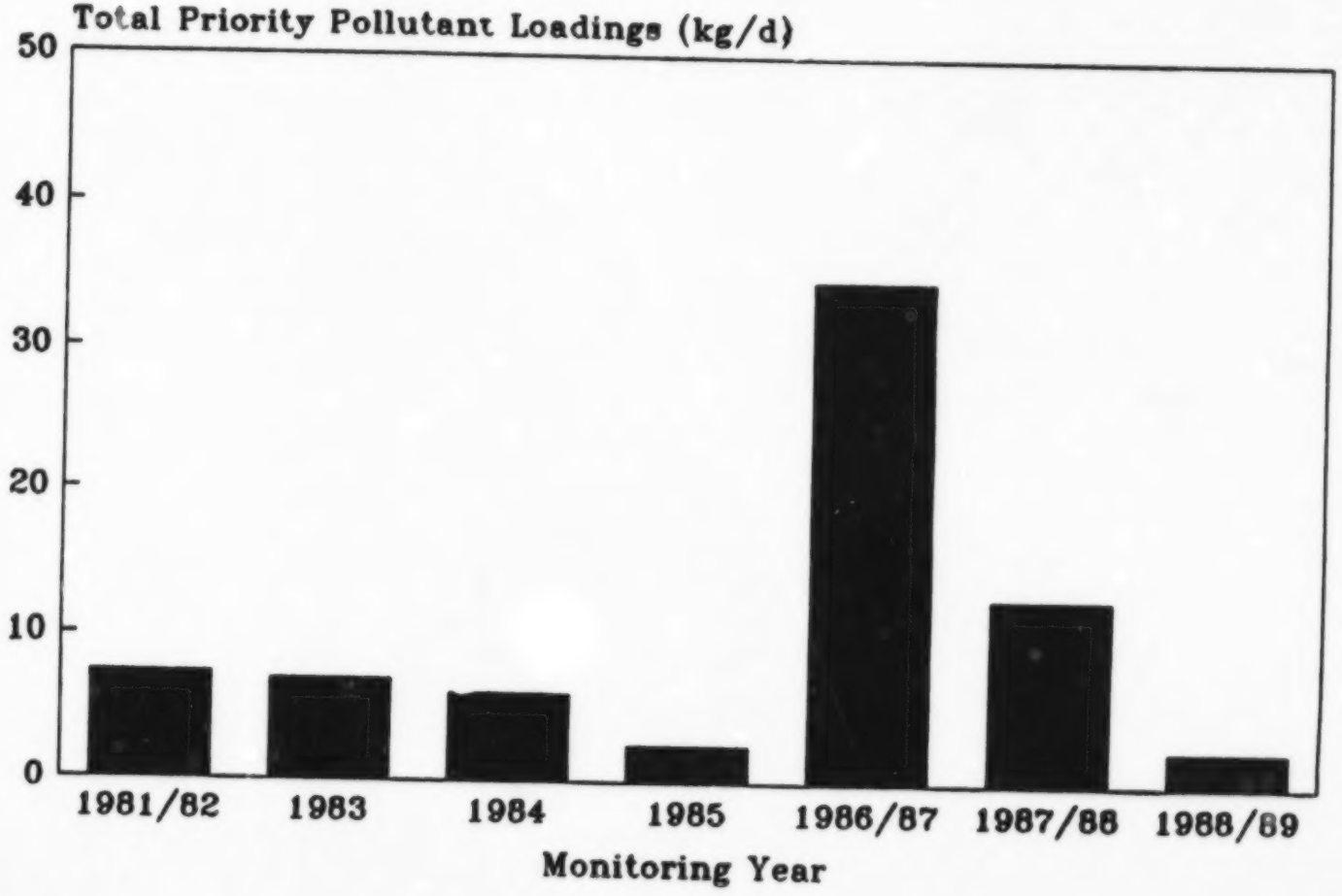

FIGURE 8

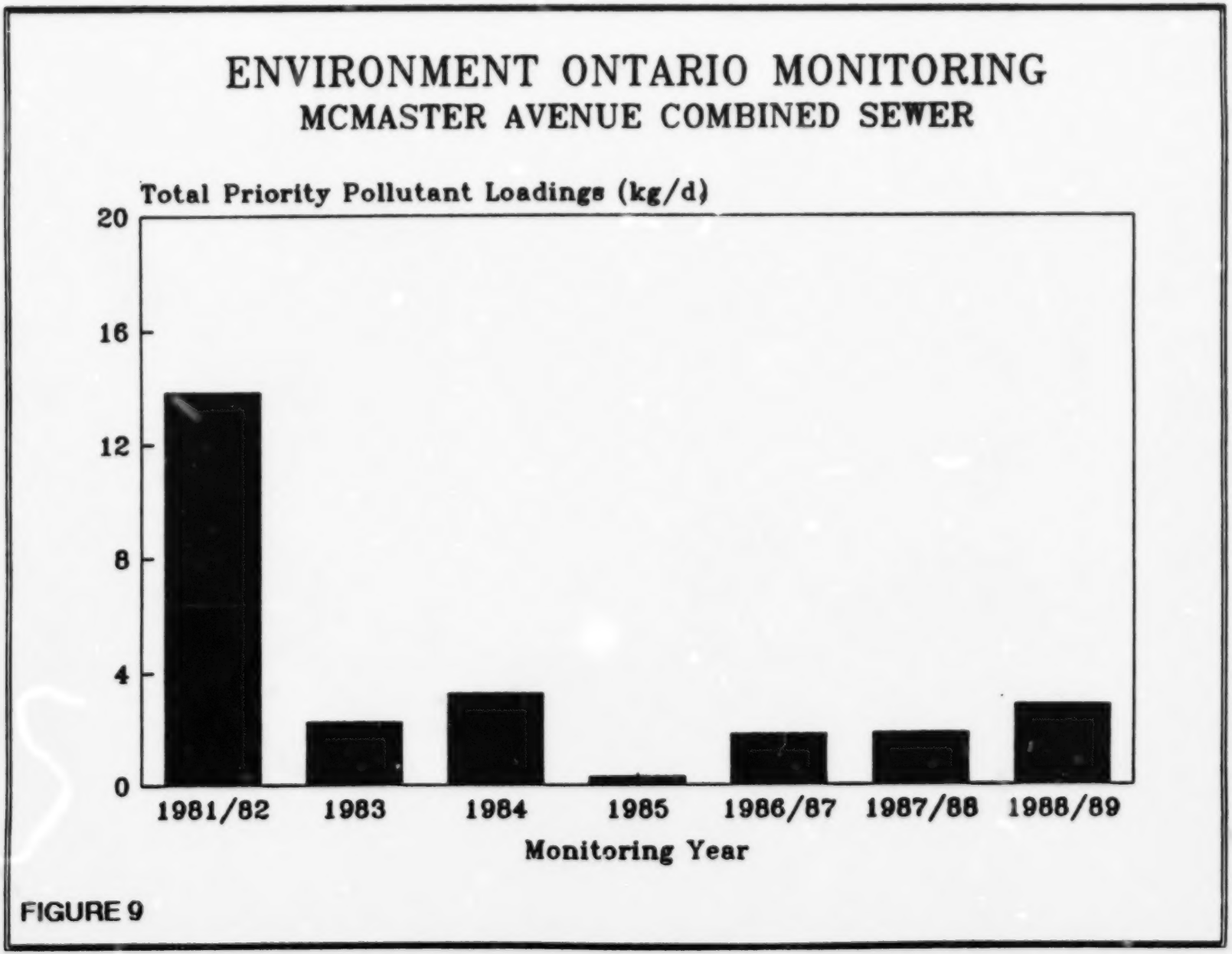
ENVIRONMENT ONTARIO MONITORING
MCMASTER AVENUE COMBINED SEWER
Total Priority Pollutant Loadings (kg/d)
20
16
12
8
4
0
1981/82
1983
1984
1985
1986/87
1987/88
1988/89
Monitoring Year

FIGURE 9

ENVIRONMENT ONTARIO MONITORING
ALL SIGNIFICANT SOURCES (8 TOTAL)

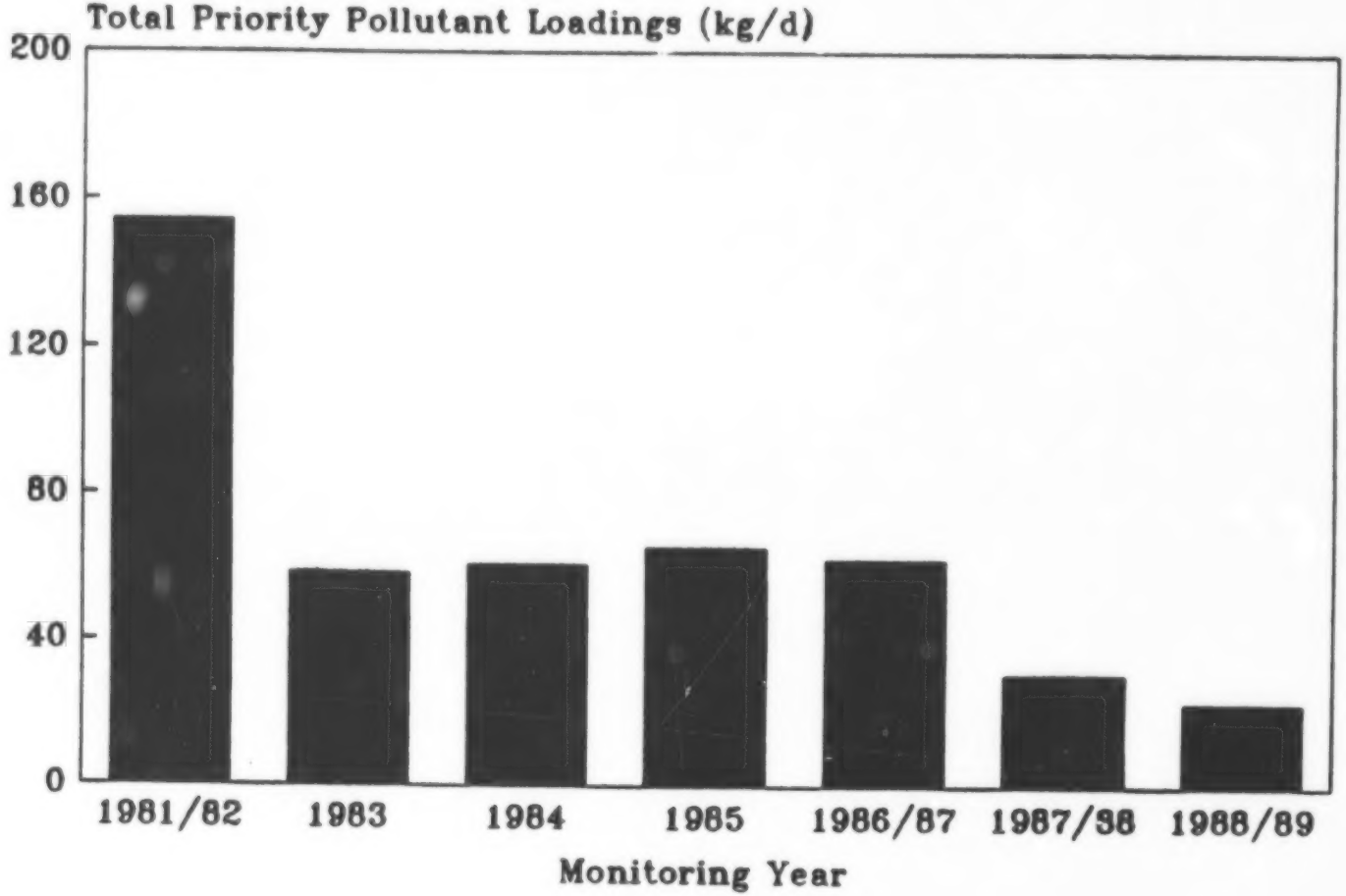

FIGURE 10

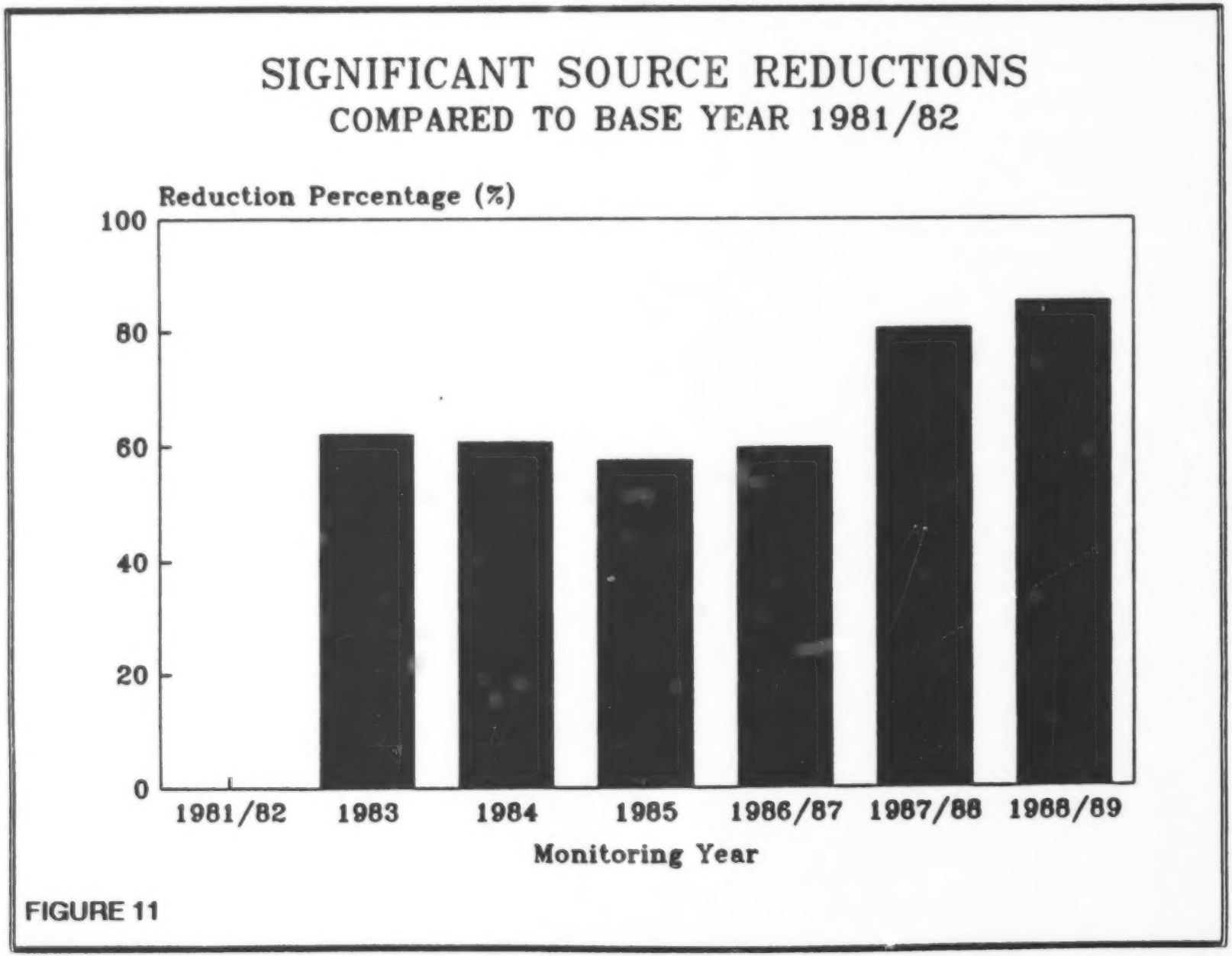
SIGNIFICANT SOURCE REDUCTIONS
COMPARED TO BASE YEAR 1981/82
Reduction Percentage (%)
100
80
60
40
20
0
1981/82
1983
1984
1985
1986/87
1987/88
1988/89
Monitoring Year

FIGURE 11

SIGNIFICANT SOURCE REDUCTIONS
COMPARED TO LAST REPORT 1986/87

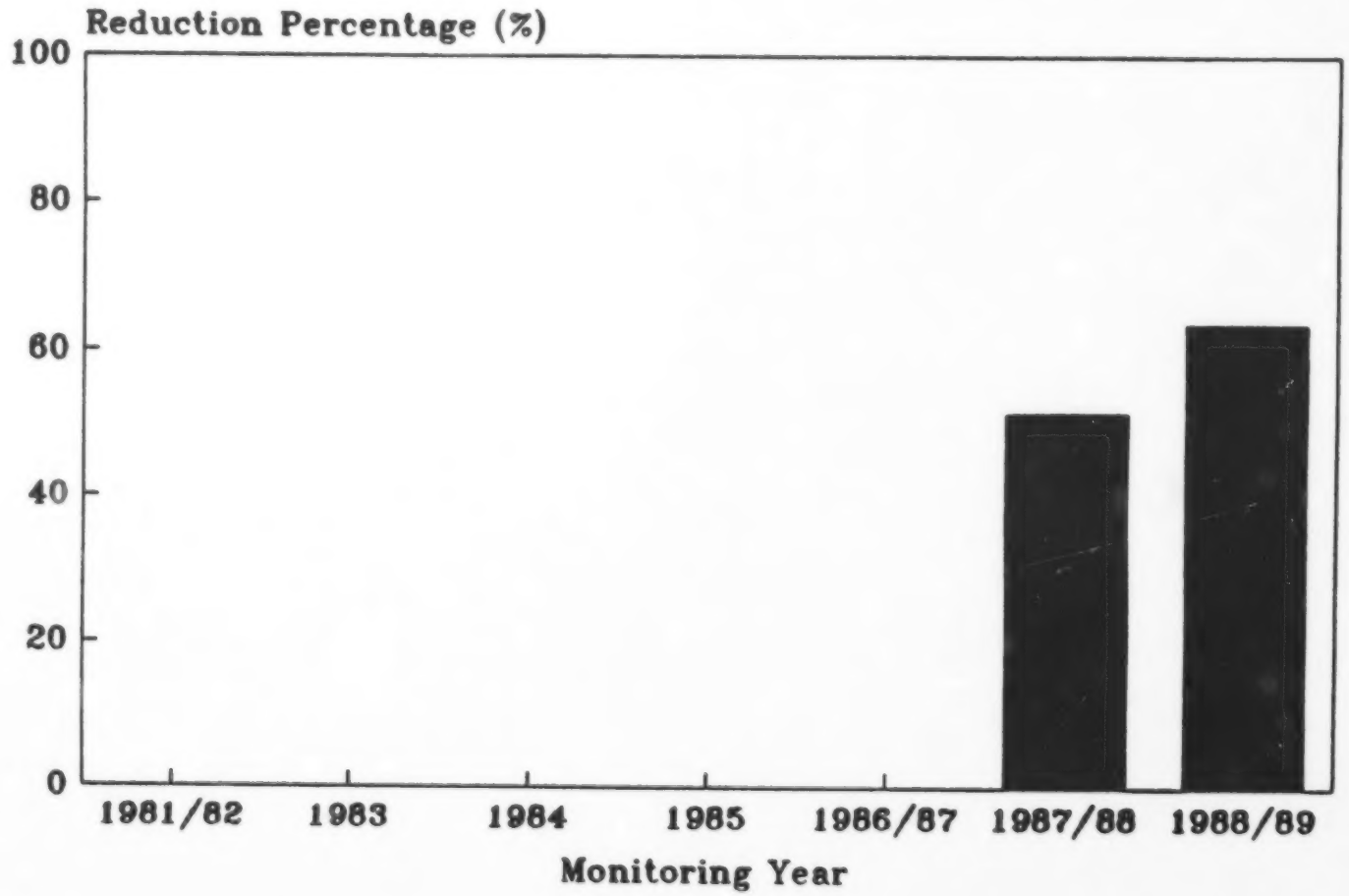

FIGURE 12